KPMG

IOWAccess Project 10

Electronic Commerce Business Plan Reference Guide

June 1998

Electronic Commerce

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Executive Summary

Purpose

The IowAccess Vision delivers government goods, information and services through a seamless Electronic Commerce (EC) process. To support this vision, Project 10's mission provides a baseline framework for the effective management of EC applications within the State of Iowa.

The purpose of this IowAccess Electronic Commerce Business Plan (the Plan) is to document the baseline framework. The Plan addresses current product and service needs, and issues affecting the State's ability to deliver information and services; and is relevant within the context of current market and competitive environments. Best Practices related to EC are explored, and appropriate standards for operating in the currently decentralized environment are promulgated.

This Plan is also intended to promote the identification and development of EC opportunities within the State of Iowa. Methods or processes for documenting the search and expansion of similar projects and resources are needed. Potential partners and contacts can then be identified early in the process, leveraging valuable and scarce State resources.

Methodology

This EC Business Plan was prepared with input from a wide range of sources:

- Discussions were held with the Project 10 Work Team. Data was gathered from externally published sources as well as from KPMG internal sources. These data were reviewed and compared with other information available on various government and private web-sites.
- Documents such as the Iowa ITS Information Technology Business Plan were also reviewed
- Phone surveys were conducted with twelve government agency representatives to obtain information regarding current and future needs and plans
- Seven representatives of private associations within Iowa were surveyed in a similar manner

The results of the data collection and analysis effort served as input to the planning process. A plan outline was prepared, and individually researched pieces were formatted to fit the required sections. Sections were then distributed for review and comment from KPMG and team members. Returned comments and suggestions were incorporated into the body of work. The plan was reviewed again for content and readability. Additional materials were gathered and adapted to provide Iowa-centric content.

Background

The issues facing the public sector today are only going to become more severe. With limited resources on the one hand and increasing service pressures on the other, governments will be forced to find ways to do more with less. Taxpayers will continue to demand more value for their money, requiring public organizations to measure performance and demonstrate accountability by reporting results. The ripple effect will have significant impact on educational institutions, non-profit organizations and associations.

In their interactions with the private sector, customers have seen the quality of products and services increase while prices decrease. Now they are expecting public organizations to do the same. They are no longer satisfied to wait in long lines for a process to be handled manually when technology could perform the same transaction almost instantaneously. In fact, the major reason for taxpayer revolts is that taxpayers don't think they are getting their money's worth. To stay in business, public organizations will increasingly have to prove that they are providing value.

"Scarce resources" was the first response from many of our interviewees (in a recent Public Sector survey conducted by KPMG Peat Marwick) when asked to consider the driving forces of the next decade. All the evidence indicates that there will be continued pressure on public organizations to control costs. However, demands for services will continue to rise, placing our clients in a very tenuous position.

Clearly, organizations serving the public will not be in a position to get bigger to meet these needs. Instead, the public sector is increasingly mirroring the private sector in the search for improved efficiency and cost reduction opportunities.

In an effort to address these many issues, governments are turning to the Internet and Electronic Commerce to provide an increase in the level and types of services they offer to their constituents.

The quickly developing area of Electronic Commerce technology offers the State of Iowa a significant opportunity to enhance its delivery of goods, services and information. However, the opportunity offered contains risks, constraints and obstacles. The EC Plan begins with a description of the environment within which the State's EC opportunities must be tempered.

Partnering Challenges

Delivering enhanced and seamless access to government services throughout the State of Iowa requires the cooperation of diverse groups, many of which do not have the common legal structure necessary to strictly impose or enforce standards. For example, this plan covers Iowa State Government agencies reporting to separate executive, legislative and judicial branches of government. The inclusion of county government bodies, municipal government agencies, business entities and private citizens makes the task of delivering services even more challenging. Success can only be achieved through voluntary cooperation fostered by an open plan with clearly stated mission, goals, timelines and expectations.

The reward for collaboration is resource leveraging. Combining needs increases purchasing power and previous experiences can be shared. Standardizing hardware, software, communications and other services with accompanying potential savings offers a powerful incentive to participate. Application maintenance reduction is an additional benefit.

Need for Standards

The need for standards throughout the State was a recurrent theme in the public and private sector interviews. A standard approach to implementing EC across state government increases opportunities to multiply benefits received and reduces uncertainty. Decisions concerning new technology are more easily made and accepted in an environment that assures work is done within a common framework. Energy can be focused on project performance instead of project methods and justification. Incentives to share costs and experience were acknowledged.

Juxtaposed against the need to conform to standards is an equally powerful need for operational freedom. Various groups have developed their own particular solutions for their own needs. These organizations are composed of diverse group cultures, reporting structures, and legacy systems infrastructures. The health of these systems vary relative to customer service, operational costs, economic returns on investment and other factors affecting decisions on replacement. Staffing and funding constraints affect abilities to adapt to or commit resources to electronic projects.

The EC Plan seeks to facilitate creative collaboration and an effective balance between voluntary adherence to standards and organizational initiative in implementing EC opportunities. Yet, we prescribe that the balance of power needs to be shifted to a focus on business and organizational goals. The objective of long term IT strategy (which would include the use of the Internet and eCommerce) must be tightly integrated with Business Strategy. Each agency or department (organization) would then follow the strategy and standards, thus simplifying the challenge of enforcement of standards.

Human Factors

By their very nature, organizations serving the public are resistant to change. Despite enormous outside pressures upon these organizations, the internal machinery will attempt to slow down or sabotage the process.

KPMG Consulting is tracking the transformation within the government sector, and we are seeing a lot of activity toward customer focused organizational alignment. Such states as Florida and Washington are breaking umbrella agencies into smaller ones, while others, like Michigan, are doing the opposite by creating a single large agency. In either case, the critical success factor is aligning the resources to address the strategic objectives.

Survey participants made frequent reference to experiences with groups imposing standards, often with little demonstrated concern about the effect upon users. Many of these EC stakeholders are very valuable within their organizations and would be difficult to replace. Real or perceived development roadblocks must be avoided. We recommend continued inclusion of these users in ongoing plan updates. Voluntary self-enforcement of standards is the desired outcome.

The Plan

Section One outlines the formal Business Plan portion of the Electronic Commerce Strategy for the State of Iowa. It provides an overview of the mission, vision, goals and objectives. It also discusses envisioned processes for plan updating and opportunity tracking.

This section is where to find the strategic direction of EC opportunities, and how to identify and follow the appropriate processes and standards to follow.

The last portion of the Plan's Section One presents a schedule of milestone events anticipated over the coming eighteen months. The schedule assumes the Plan's adoption in July of 1998 and that a Project Office is established and staffed without delay. By 1998's calendar year end, a database of project opportunities should be created and updated technical standards for EC updated and published. During the first half of 1999, the Advisory Board should be fully operational and EC in Iowa should be targeting proactive opportunities for new projects. By the end of 1999, there should be enough data to support specific recommendations by the EC Project Office and Advisory Board for changes to Iowa government operations.

Section Two provides information and examples of various processes and methodologies to employ while evaluating individual EC opportunities.

This section is where functional users may find information on how to compare opportunities that are in competition for available resources. It discusses what to look for and how to use such information.

Issues

Access

Equitable access is a concern that may be solved through rapidly evolving technology. The use of Internet/web solutions, which are growing rapidly, may ultimately resolve much of this concern. web interfaces through television, cheaper computing devices limited to web applications and the cable television/satellite industry evolution are examples of where ultimate solutions may come from. Costs to access through Internet Service Providers (ISPs) have been steadily declining. Web access is increasingly available through expanding school and library linkage. We recommend that web-based solutions should be pursued for their multiple benefits. Current trends suggest that the market may offer more ubiquitous access options within the near future.

Legal

Potential legal issues such as privacy and authentication exist regardless of service delivery mechanisms. With the huge web audience, each content provider (agency or group providing the material/information) must be responsible for information made available, and to whom this availability is granted. Once data is outside an organization's firewall, it is out of their control. Government agencies must decide and defend what information is truly public record, and who may have access.

Training

The sophistication level between groups varies considerably. User training requirements will reduce over time as school programs and private use of computing and communications technology increases. The use and reliance on industry standard software packages will reduce the number of internal and external training programs required. Repetitive solutions such as the availability of standardized web pages allow groups with minimal technology staffing to participate sooner with less training. Common applications and increased daily usage will alleviate some training needs.

Partnering

Partnering relationships between public and private entities need to be monitored and better defined. In some instances networks with useful information are legally off-limits to private enterprise. Some private organizations would like to make use of public controlled networks. These organizations provide services to Iowa and are also customers of government services. This is illustrated in sub-contract arrangements where private parties operate official programs in full or part.

Recommendations

Ownership

It is the intent for the State of Iowa to adopt standards contained within this document. For the purpose of open planning, the owner of this plan will be the Office of Information Technology Services (ITS) for the State of Iowa, or their designee.

The duties of the plan owner include regular updates. This will ensure the plan is current with the needs of various constituent groups of the Citizens of the State of Iowa. Continual changes in technology, legalities, expectations and user needs make this update process critical. The Plan needs to be understandable and accessible to the widest possible audience.

The purpose of central ownership of this plan is to make clear to all concerned where the accepted EC standards are housed. Citizens know where to come for clarifications and adjustments. The procedures for inquiry and suggested changes need to be openly communicated.

User Advisory Board

Internet success has often been obtained through true ground-up development. We recommend that this force be harnessed by formal participation of the users who will live with the resulting systems daily. Approval of Plan changes by this group must be mandatory. Participants should include representatives from state, county, municipal, private, and business organizations. The Plan owner's function is to serve as facilitator and leader for this group.

The User Advisory Board provides a format for the continued collaborative participation of interested parties. Long-term success can be achieved through the balance this forum provides between individual and common needs represented by the centralized standards authority.

Project Office

We recommend a group be created to organize and provide information on EC projects planned or under way. This Project Office would fill a number of important roles.

The Project Office provides an enterprise-wide view of Electronic Commerce initiatives across the State, with the following benefits:

- Leverages economies of scale, particularly when making investments in re-useable architecture and infrastructure
- Ensures definition of, and adherence to, standards
- Enhances systems integration, and ultimately process integration, across government agencies

This office would collect and categorize information on potential EC projects. Identification of similar projects and matching potential partners with similar interests or resources with previous experience would be easier.

Technical assistance related to standards or documentation may be offered. Projects not fully funded may be joined with others for potential savings.

The creation of a small group to keep the pulse on EC project activity within the State is highly recommended. The coordination of the increasing magnitude of projects offers the opportunity to significantly leverage resources and economies of scale.

Standards

The Plan sections cover hardware and software standards, and EC best practices. By adopting well-known standards and leading technologies, adherence to the Plan will deliver the ability to exchange information efficiently and economically.

Standards exist for the promotion of common interaction points between potential partners. Private industry recognizes that business partners have a stake in supplier and customer information. Linking this information electronically benefits both parties. The ability to interface data and systems has dramatic savings potential in cost reductions while improving customer service and satisfaction.

Process

This document serves as a guide to all potentially involved in EC solutions. Constituents will be the beneficiaries of the rewards of doing business in new ways. Participation will be encouraged by the use of well-supported and documented methods. The Plan will serve as an enabler for well-planned growth. It leverages industry or state standardized solutions with accepted IT elements to satisfy user requirements. In the current competitive environment, use of such standards in recurring solutions allows participants to reallocate scarce resources to unique portions of projects and solutions, away from the overhead of reinventing similar solutions.

Supplementary Materials

The Plan provides material regarding EC-related projects. EC projects have been identified from the Iowa State IT Strategy, survey responses and work group discussions. They have been categorized by "technology type" for easy reference. Categorization by solution /technology type and by agency creates a 1 to 3 year roadmap of what technologies are desired. This roadmap helps ITS identify and plan for learning curves, new technologies and potential staffing changes. Suggestions and examples of how to evaluate this work are provided. Software and spreadsheet tools have been included as well.

Conclusion

The IowAccess Project #10 EC Business Plan consists of recommended standards and processes. Methods are designated for creating and maintaining systems related to EC within the State of Iowa. The application of these standards and methods are for the purpose of making EC-enabled systems effective and efficient, while retaining the freedom of development to those performing the work. The success of this plan will be measured by the ease with which EC applications matriculate toward fruition.

Enforcement of these standards is nominally vested in the plan administrator. Actual enforcement will come from the users themselves, recognizing that these standards make good business sense and make doing business within the State easier and more effective.

The evolution and execution of this plan provides a solid foundation for future information delivery infrastructure within the state. Common values and standards lead to effective systems investment and development, while maintaining the benefits of true entrepreneurial application systems and services creativity. This creativity is the premier asset of true decentralized, ground-up systems development, which defines the Internet and the World Wide Web.

The adoption and execution of this Electronic Commerce Business Plan is an important step in the State of Iowa's business environment evolution. It displays the State's commitment to maintaining its leadership position in adapting technology to accomplish improved services goals. The theme of partnership for entities throughout the state will yield better long-term solutions than planning performed in isolation.

Recommendations consider the timing and impact of solutions on affected parties. Prioritization and timing reflect where delay is appropriate to enhance the value of a solution over the long term. Opportunities for early success build momentum and excite participants in taking next steps. Regular review and continued cooperation is the key to receiving the optimum benefits. Adaptability is both the plan's objective and its greatest value.

1 Section 1 – The EC Business Plan

1.1 Introduction

The Electronic Commerce Business Plan contained in these pages is a living document designed to be modified to maintain its applicability to Iowa's evolving needs.

The Plan contained in Section 1 is intended for the benefit of those involved in the planning of EC-enabled applications within the State of Iowa.

It is broken down into sections. Section 1.2 discusses the environment which such applications find themselves in. This environment includes recent EC activity throughout industry. EC Solution areas of closely related applications are presented. The Competitive Analysis sub-section addresses customers and their needs, changing products and services offered and applications of competing locations. Current and future legal constraints are then reviewed.

Section 1.3 catalogs existing EC opportunities within the State of Iowa. Information gathered in surveys is presented in support of these potential applications.

Best Practices in EC applications are offered in Section 1.4. These are reviewed from the perspective of organizations, technology and security. Some guideline benchmarks and performance criteria round out this section.

Plans for Action related to organizational needs, operating next steps and opportunity recommendations are listed next. The plan addresses the infrastructure needed from both a technical and human resource perspective to support the envisioned EC applications. Areas to be investigated further are listed, and suggested milestones are offered to provide guidance in placing the Plan into action.

Finally, a process to maintain the Plan is recommended. Experience with the dynamics of particular groups will suggest changes down the road. This process provides a roadmap on how to proceed until such experience is obtained.

1.0.1 Background

Preface

IowAccess is designed to be a grassroots initiative involving a large cross-section of Iowa's population. IowAccess is an innovative, cooperative effort of local, state and federal governments, the private sector, and Iowa citizens to make accessing government information, applying for permits, and submitting required information easier - especially for citizens. IowAccess is comprised of 14 projects, the development of a State-wide Electronic Commerce Business Plan being Project 10. It is only appropriate that IowAccess partners become ambassadors in their mission to create a more efficient, user-friendly, and accessible government.

This business plan was written for the State of Iowa by KPMG Peat Marwick, LLP Electronic Commerce Consulting. It is for use by all constituents of the State of Iowa, whether it is a government agency, a public company or a private citizen.

Description of IowAccess

Vision

By the year 2000, IowAccess will be able to deliver government goods, information and services through a seamless EC-enabled process.

Mission

To provide a process and/or framework to identify, prioritize, and select government goods, information and services that can be EC-enabled.

Scope of Business Plan

The IowAccess EC Business Plan (Section 1) is a process specification, or framework, for identifying and evaluating electronic commerce opportunities in the State of Iowa.

Electronic Commerce Defined

Electronic Commerce (EC) should be considered a technology enabler to process-dependant solutions, not the solution.

EC can be defined as "The exchanging of information, goods and services over networks and the use of networks to supply and retrieve the information necessary to support these transactions." This can be accomplished via e-mail routers, EDI transaction sets, SmartCards, ATMs, digital checks, web-site interfaces and so on.

EC enables business transformation in many ways, including:

- Business Process Improvement
- Cost reductions
- Increased Productivity via better-leverage internal assets
- Transformation of business relationships
- Flexibility to adapt to change
- Cultural and organizational transformation

EC technologies enable the transformation of processes internally and across agencies, business and citizenship through the timely delivery of:

- Information
- Knowledge
- Services
- Transactions

Roles:

Owner

Overall ownership should reside with The State of Iowa, whereby delegation of roles and responsibilities occurs through The Governor's Office. Specific roles and responsibilities are identified as follows:

Administrator

The administrator of the Plan should be Information Technology Services (ITS). Responsibilities include, but are not limited to, keeping the Plan current via scheduled Plan review and modification events, publishing and otherwise making visible all EC initiatives concurrent state-wide, and maintaining a central project repository and progress tracking system.

Enforcement Agent

ITS should maintain overall authority ensuring compliance to the State EC Plan. Compliance to technological requirements resides with the State IT Plan. Specific compliance to agency objectives are the responsibility of each individual department or agency.

Approval and "Seal of Approval"

Approval of EC projects can come from many different levels. Generally, initial approval will come from the agency/department funding the project. Upon satisfactorily meeting EC and IT Plan objectives, the ITS shall issue a "Seal of Approval". The Seal of Approval should be the goal to achieve. Award of this Seal signifies that the project complies with all current and applicable State ITS, IowAccess and EC rules documentation.

Stakeholders

Stakeholders are classified into primary, secondary and other.

The primary stakeholders are local, federal and state governments, private industries, and the general citizenship of the State of Iowa. The roles of the primary stakeholders will be to use the selected EC applications and provide feedback.

Secondary stakeholders are the project sponsor(s). The roles of the secondary stakeholders will be to ensure a quality product delivered within scope, within budget and on time. Additionally, the project sponsor will also be responsible for reviewing all functional aspects of the delivered product.

Other stakeholders include baseline technology partners such as cable providers, phone companies, EDI vendors, and standards bodies. These entities are interested in the success of EC projects and may even take on equity or investment positions.

Access and Training Implications

The cost, the ease and the way through which people interact with their government is likely to change as government moves towards an electronic town-hall environment. Equity, education and training are vital if EC is to be accepted by citizens of Iowa.

There are significant opportunities in an EC-enabled government; however, the largest hurdle to overcome is acceptance. Resistance to change can be reduced via programs designed to cover product awareness, product training, discussion of benefits, trust in the product, and maintaining quality levels. Ultimately, the goal is to create a seamless way to access government information and services that compliments the traditional way constituents currently access government.

Educating and training personnel on using the new technology is imperative for any electronic government to work. There may be a cultural reluctance to change for some people, but by involving providers and customers in the development of a system, some of the reluctance may be overcome. By educating and training personnel for the psychological and organizational impact, they will come to understand that standards are customer-driven and resulting in better service.

Intergovernmental Cooperation Opportunities

In a globalized environment, governments and industries are re-engineering to meet their constituents' needs. By working together inter-governmentally, service delivery can be enhanced. Pilot projects, public/private partnerships, and cooperative use of human and financial resources are ways EC can thrive in the State of Iowa.

The IowAccess EC Plan provides a baseline framework for the effective management of EC applications in the State of Iowa. The Plan, accompanied by the Guidebook, will effectively instruct the user in the identification and development of EC opportunities; i.e., the creation of a business case/model.

The Plan is not meant to be restrictive at any level of use. Instead, it is meant to provide a consistent and structured approach to identifying, developing and implementing EC-enabled applications to meet various functional needs. In addition, the Plan encourages intra-agency collaboration as many times an EC-enabled product will benefit by multi-agency efforts. The Plan also provides for baseline technology standards, best practice models and recommended key responsibility areas. The Plan is to be reviewed and modified where appropriate, on an annual basis at a minimum, to ensure effectiveness as Iowa's EC needs mature.

1.2 Environment

This section provides an overview of the current business environment as it relates to electronic commerce.

Recent EC Activity covers some current projects taking place around the country at various levels of government.

EC Solution Areas discusses target markets and EC products where EC provides a range of related solutions. By concentrating effort in subsets of EC applications, success can be achieved by quick specialization of available resources.

Competitive Analysis provides a discussion of the issues affecting relationships with customers. Ways of looking at services and products offered to customers, and possible alternative methods of delivering their needs are covered. Challenges in attracting and keeping business activity close this section.

The final section discusses legal issues with regards to EC. A review of the areas affected is presented, along with a survey of EC legislation.

1.2.1 Recent EC Activity

It is often useful to look at what others in your line of business are doing. The following pages are a partial listing of some recent EC Initiatives planned or under way across the United States. These listings display a wide variety of applications, at various levels of government.

Recurring themes come to the surface. Distributed applications such as license and permit issuance are widespread. New purchasing and procurement systems are also being implemented across the country. Communication links with other governments are increasing in priority. Another growth area is the use of geographical data for use in planning systems.

Such a listing demonstrates the strength of the EC solution areas. Systems can be created by using relatively inexpensive software and hardware to address needs. It also exposes a potential lost opportunity to coordinate such development. The advantage in coordination and planning is in the creation of interrelated approaches and systems at an enterprise-type level. This reduction of data input, duplication and time lags can lead to efficient applications serving a number of related parties.

Recent Project in Other States

Alabama	**Purchasing Site**	Procurement news and latest contracts
	Rehabilitation Page	New, provides information and links to other rehabilitation sites
Alaska	**Department of Fish and Game**	State regulations, licenses, permits and procurement
Arkansas	**Smart Stamps**	Electronic benefits transfer to pay for Temporary Assistant to Needy Families
	Aid-Fingerprints	AFDC recipients required to provide fingerprints prior to receipt of assistance
California	**Department of General Services**	State-wide procurement system
	Santa Barbara County	Payroll and human resources management and strategic business model
Colorado	**Procurement**	Bid Information and Distribution System (BIDS) helped reduce time to post a bid from 3 days to 3 hours. Vendor access up 15% since September 1997
	Human Resources	Boulder employs 1240-2800 in season, now using 1000 workstations
Connecticut	**Health Care**	HUSKY provides details on proposed Healthcare Uninsured Kids and Youth Plan
	Motor Vehicles	Information around the clock for titles, licenses, etc…
Delaware	**EPA Grants**	Participating in Partnership 2000. Automating grant lifecycle, work plan negotiations and grant awards
Florida	**Traffic Enforcement**	Awarded contract to automate the traffic citation process that 67 counties to use
	Jobs	Dade County will connect 30 organizations to offer welfare receiptants access to jobs with Lockheed Martin
Georgia	**Videoconferencing**	Uses Georgia state-wide Academic and Medical System for Revenue Department Interaction with other state organizations

Hawaii	**Health Care – Children**	Early identification system used to run Healthy Start program to identify families at risk of child abuse and neglect by assessment of family factors before birth. System yielded results, such as attrition rate measurements allow corrective program measures to address what had gone wrong.
	Business Information	Information on operating a business in Hawaii-registrations, licenses, federal requirements, forms, applications, tax and trademark information
Illinois	**Justice Information System**	McLean County has implemented a system which integrates computer–aided dispatch systems, booking stations and fingerprint identification systems. Expected to save $1.2 million annually.
	Fiscal Data	State-wide Accounting Management Systems (SAMS) lists basic facts, such as annual housing cost/inmate, railroad bridge repair, etc… State hopes to save $4.5 million in Year 2000 expense reduction.
Indiana	**Inkless Fingerprints**	13 sites to install electronic high resolution digital images
Kansas	**Geographic Information Systems**	Olathe, Kansas layers a system on top of Johnson County's to create a "zoning browser" for use by planners, by 300 foot zone parcels
	Child Care	Kansas Kids – Children's Network web page provides state-wide information preschools, county referral agencies and child care assistance
Kentucky	**Education**	Listing of information for Council on post-secondary education; profiles, policies, publications, tuition, fees, etc…
Louisiana	**Linking Lines**	Arts
Maine	**Help Desk**	State Information Services Bureau
	Medicaid Management	Medicaid decision support system on a central healthcare database. Estimated cost reductions -- $7 million over the next 3 years.
Maryland	**School District**	Keyboard Video Mouse (KVM) switch to simplify Internet access, reducing the number of monitors and keyboard needed at schools

Massachusetts	**On-line Education**	Virtual State House (VSH) graduate course at MIT
	Geographic	Hood Links -- access neighborhood information by street name, obtain maps and information on hospitals, schools, libraries and police stations. Boston gets 7,000 hits per week.
Michigan	**IT Purchasing**	Restricting state buys of desktop PCs to specific vendors. State expects to save 12.% on each sale.
	Child Enforcement	WWAN to support enforcement systems; cost -- $650,000 with expected savings of $1 million per year
Minnesota	**Global Trading**	United Nations Global Trade Point Network (GTPNet) links trading partners in China and Australia to North America via secure international electronic trading gateway. Over 20 million electronic trading transactions are made monthly.
	Traffic Analysis	GIS to model traffic patterns, surface and raster data, images and spatial data
Mississippi	**Legislative**	Each member of State Legislature received wireless notebooks for 1997 session
Missouri	**Procurement**	Procurement reform on track after Year 1, estimated savings $10 million over 5 years. Single vendor hardware/software vendor replaced over 70 contracts in September 1996.
Nebraska	**Arts**	Information on Nebraska Arts Council and information on grant programs eligibility and applications
Nevada	**Geographic Information System**	Study resulted in a MS Power Point-based high level assessment of state's geographic information systems needs
New Hampshire	**Resource Network**	Office of State Planning put planning and geographic systems data on web for municipal planers, town officials, resource managers and the public
New Jersey	**Revenue**	Information on filing tax forms and payments, miscellaneous information
	Fingerprints	State Police and 7 metro areas will live-scan and process a quarter of the state's arrests
New Mexico	**Long Distance**	New contract with estimated savings of $1 million per year, by reducing previous T1 costs

Nevada	**Secure Transactions**	Utah's Digital Signature Act lets state court clerks accept documents containing signatures; voting, hunting licenses, etc…
New York	**Web Investment**	Center for Technology in Government has introduced a suite of tools that will help organizations estimate what to expect to create a web-site. A written guide for web investment decisions, and an electronic spreadsheet for making cost assessment. http://www.ctg.albany.edu/projects/inettb/SpreadSheets.html
	Best Practices Report	Includes streamline project scope, careful selection of project leaders; project promotion to decision makers and using industry standards http://www.ctg.albany.edu/resources/pdfrpwp/iis1.pdf
North Carolina	**Law Enforcement**	Charlotte-Mecklenburg Police Department will distribute 1,200 notebooks to officers
Ohio	**Law Enforcement**	Akron-Mobile wireless system for police, fire and emergency medical services
Oklahoma	**Rehabilitation Progress**	Oklahoma City tracks milestones for its disabled clients, not the dollars
Pennsylvania	**911+**	Montgomery County has a system that includes directions and medical data on residents, billed to citizens who sign-up by questionnaire on phone bill. Notifies designated relative, caregiver or neighbor within minutes of 911 call
	911+	Berks County installed same as above at about $8 per month
Rhode Island	**New Web Link**	A page of links to state-wide planning program page, allows users to access other planning and allied agencies
	Child Welfare System	Child abuse and neglect cases; set to roll out in March 1998
South Carolina	**Technology Council Site**	Technology Advisory Council site helps set future goals for technology use. Lists council's goals and recommendations, mission, council members, benefits of state's technology strategy and priority technology areas.
	Quick Response	Greenville County gets dispatch software to cut 911 response in half through resource allocations, displays, routing recommendations, etc…

Tennessee	**Child Care**	Human Services and Child Support Department has removed on-line barriers between county and states lines looking for deadbeat parents. System links 31 child support enforcement offices, 200+ court clerks across the 95 counties
Texas	**Pet Adoption**	Digital images and information to help simplify adoption of 74,000+ dogs and cats picked up each year
Utah	**Link**	Adds institutions to state-wide telecom network, 550 of 740 public schools
Vermont	**Geographic**	Problems – U.S. Census does not match state's standards for GIS data. State plans to form data-sharing partnership with towns, 911 board and census.
Virginia	**Department of Motor Vehicles**	Contract to provide credit and debit card authorization. Estimates of 12% of customers will use new payment method this year.
Washington DC	**Automated Fingerprint Identification**	Contract let to upgrade existing AFIS system, second will include installation of new distributed identification network with multiple live-scan capture. Hope for faster arrest processing through decentralized booking.
West Virginia	**Web Link**	Link to on-line services including; maps employment information, tax forms, state contracts and motor vehicle division forms
Wisconsin		State departments (Health and Family, Transportation and Workforce Development) are devising a benefits card for applications like medical assistance, drive licenses and food stamps
Wyoming	**Tourism/Recreation**	Snowmobile home page linking trail reports for 11 areas updated weekly, in season. Also links to several permit selling agents for $15 decal.
	Video Conferencing	Saved agencies over $700,000 last year in travel. Network serves 26 agencies and 24% of private industry in the sate. Covers 97% of state, putting no citizen more than 50 miles from a VC Center.
Sources		GCN State and Local, KWEB

1.2.2 EC Solution Areas

Solutions in the EC area can be stratified multiple ways. This would include targeting specific markets to address. Specific applications can be identified and rolled into categories of solutions.

Target Markets

There are five identified primary markets to consider when developing EC-enabled applications.

- Government to Government (including international affairs)
- Government to Business
- Business to Government
- Government to Citizen
- Citizen to Government

The first market may be the most difficult to address in this plan. Beyond the borders of Iowa control goes beyond the scope of this plan in terms of authority to arbitrate a solution. The next four seem very logical.

Targeted EC Products

By comparing the projects listed in the previous section with the Iowa specific projects listed on the chart in Section 2.7.1**,** similarities and gaps appear.

There are 13 states where benefits transfers and Medicare-related reporting systems are targeted. Eight states had law enforcement projects mentioned. Six states listed educational systems. Other categories mentioned were Geographical (5), Financial Reporting (5), Regulations publishing & licensing (4) and Purchasing systems (4).

The chart of applications expressly stated in the Information Technology Business Plan was categorized by application type, not subject. When tracing the 40 agencies included in the plan, similar interests appear. Information Management and Data Warehousing applications were stated by 31 agencies. E-mail and telecommunications, Internet access and Computer Based Training were all mentioned by over half of the agencies listed. Information publishing and web-site publishing were mentioned in over one third of the responses.

There is increasing desire and need to gather and disburse information to appropriate parties. The use of the Internet and other public networks for such activity shows the business logic of using existing tools where possible. Where safeguards are not yet in place to protect privacy or confidentiality, other distribution channels are being sought while tools catch up. The choice is between how and when to grant access to information, not if to grant access. EC applications must be evaluated on the foundation of legal needs and available infrastructure.

Based on the responses to surveys and planning documents, the following short-term EC Applications should be targeted for investment:

- Information Publishing - the ability for organizations to provide information to their customers and suppliers. Most often associated with consumer applications, this group gives payback in a variety of areas. Information available to technology proficient consumers offers a marketing edge. An automated method to respond to standard questions can be less expensive than human interaction.

- Computer Based Training - with the convergence of content and multimedia, the ability to offer training when and where needed is a major improvement, particularly in geographically dispersed rural areas.

- Information Management / Data Warehousing - an outgrowth of the individual application program development process. Most organizations have data spread out over a variety of hardware and logical storage devices. Redesign or re-engineering to take advantage of existing data to eliminate entry steps, duplication and contradictory information holds the promise of increased accuracy and efficiency.

- Process Oriented Opportunities - similar to the opportunities in Information Management, the design and implementation of new systems provides the chance to upgrade processes. The introduction of Best Practices is not just a smart step in technology, but in manual processes as well. Utilizing the latest decentralized systems design techniques available, the chance to eliminate or reorder steps in a process should be considered. The chance for errors is reduced by having facts available to verify on the spot of interaction or transaction, while documents or other information is at hand.

- Financial Management / Reporting - the ability to retrieve data from applications is a key tool in turning many financial reporting systems from an after-the-fact perspective to a current management operational tool. The ability to look at data in different ways without interfering with central applications is of high value. Often current methods involve parallel systems with duplicate input, which introduces reconciliation tasks.

- Internet Access -as personnel become more proficient, attention should be paid to the need for obtaining information at many levels from outside the organization. Just as the organization should consider publishing information for customers and suppliers, the need to obtain information in return via these same methods should be expanded through the ranks if appropriate.

- E-mail, Telecomm, User-groups - as organizations grow more connected, the methods of communication offer possible process improvements and savings potential. The use of industry standard applications and the systems to implement them is recommended, and the systems in use at customers and suppliers must be considered. Ability to interact with these parties is key to reducing the quantity of interactions/transactions and the associated costs.

There are many other EC products and applications to consider. Those listed above were most often mentioned by Iowa government agencies, and would appear to have the widest impact on their way of business.

Strategic Opportunities

- Opportunities to improve organization workflow can be strategically evaluated. The following areas relate to Internet/Intranet solutions utilizing EC applications.
- Web Site Branding and Publicity - the organization must get the customer into their solution area. The customer must come in the door to buy something. Where is your customer, and how do you get them to your site?
- Knowledge Management – important information may be overlooked due to the volume and variety of documents. Efforts to reduce document publishing time, duplication and distribution costs are key. Improve the acquisition of outside information through the Internet and other sources.
- Communication – convenient e-mail throughout the state would be helpful. Once web-sites are in place, the methods to respond to the public become critical.
- Collaboration – workgroup management, forums, listservs, user groups, conferencing through the desktop and new tools need to be investigated for applicability.
- Applications Enabling – web opportunities include customer product/service tracking, vendor relations, general administration such as time sheets, human resource systems, employee benefits, training and retirement applications.
- Electronic Commerce Transactions – paperless contracting, cost savings, competition enhancement, reduced lead times, fairness, equal access for all parties and facilitation of open communications are potential benefits here.

1.2.3 Competitive Analysis

At first, it may appear that no real competitive advantage exists in government systems, since there is only one government to serve the wide-spectrum of constituency.

People and businesses have more location choices with increased mobility than ever. Intellectual property is a growing segment of the asset base. This property can easily follow the owner(s) in relocation. More than ever, governments are competing with other entities. This competition is for plants, jobs and population. These segments feed off each other. People will live where good jobs are available. Those factors include taxes, infrastructure, legal environments and access to government services. Governments must become capable of competing in these areas or face potential decline in their area.

There are distinct advantages to being first to market, to having automated 24-hour systems, or having interconnected seamless access to government services. This cannot take place without the total support and participation of multiple and widespread governmental agencies. Therefore, competitive advantage in a government can be derived from using the cost-effective capabilities of IT that allow the government to better service its constituents. Some of the competitive value can be quantified by performing the feasibility analysis found in section 2.

1.2.3.1 Customers

The customers of government goods and services within the state may be categorized. Private citizens, business entities, educational institutions and other government units are some of the major categories. Simplification leads to the common denominator, that of the citizen. A good environment provides the goods and services that the public needs at an economic price. This enables the population to grow and flourish. This makes an attractive economic base for the creation and maintenance of jobs. This economic base provides for the enhancement of opportunity for the citizens.

In the current business environment, the competition for population is increasing. The ability to relocate both people and businesses in shorter timeframes must be recognized. Long term economic development depends on a competitive business and lifestyle environmental development.

1.2.3.2 Other Products and Services

People and businesses are becoming more self-sufficient. They are demanding better services and products in a reduced time frame. Across the nation, services which were provided by government or regulated monopolies are being provided by private enterprise. Often these services are less expensive and of better quality.

To compete effectively for population and economic development, services must be competitive in both quality and cost. New delivery mechanisms that offer “quality upon demand” must be explored.

Faster and more accurate delivery of products and services allows for reallocation of resources to meet the most critical needs.

1.2.3.3 Other Locations

In the developing information based economy, the value of intellectual property and licensed production by virtual corporations makes it easier than ever for businesses to relocate.

It is vital to geographic areas to attract and maintain businesses to support their population. Businesses will respond to economic incentives and work force availability.

If a local area has an adequate employment pool, a business can still relocate within an acceptable commute time and attract the desired workers. This is usually done for monetary incentives, but can also include paperwork or other costs differentiated between areas.

Should the worker pool no longer provide the right workforce, businesses will shift production where possible, and consider relocation in the long term.

While areas must compete for current businesses, an eye to the future is advisable. Increasing amounts of work are being done by small and home-based businesses. These entrepreneurial ventures require support and encouragement. The economic potential of this group could be vital to future growth. This is a prime example of how new products and services must evolve from government. Questions should be answered as what the population needs to compete in this arena and how revenues are created to provide support.

1.2.4 Legal Constraints

Legal Landscape Survey

At the time of publication, few if any, legislative requirements are guiding EC in the State of Iowa. Without a well-defined set of "rules," the best interests of governmental and privatized EC applications are not protected. As the legal landscape changes in the State of Iowa, the business plan should be automatically reviewed for compliance. Until such legislation is enacted, the following areas may be affected by pending and future legislation:

- Equitable access
- Electronic records management
- Privacy
- Data security
- User Training
- Cost and Pricing
- Public-Private partnering relationships
- Telecommuting
- EC incentives

Digital signature legislation will be an important EC element. While issues such as the relative weight of digital vs. handwritten signatures, the authorized issuing party/parties and others are worked out, it is important to go forward recognizing that legislation will likely be passed at some point. Planning and process design can take place without final details being known.

Legislation

Currently more than 40 states have either enacted laws recognizing digital signatures or are considering legislation. Currently, legislative requirements for digital signatures vary widely between states. The federal government has also proposed and passed legislation concerning electronic communications. Current federal law restricts the export of encryption technology using more than a 40-bit key for national security reasons. In domestic versions of software that use encryption, there is no restriction on key size save that of performance. The larger the encryption key, the slower the communication. Listed in Table 5 are some proposed bills and federal regulations pertaining to electronic commerce.

Table 5: Electronic Commerce Legislation

Bill	Name	Description
S. 376	Encrypted Communications Privacy Act of 1997	Bill introduced by Senator Patrick Leahy (D., Vt.) to allow people to use encryption with some exceptions and prohibit the government from requiring that a key be given to another party.
S. 377	Promotion of Commerce On-Line in the Digital Era (Pro-CODE) Act of 1997	Bill introduced by Senators Conrad Burns (R., Mont.) and Ron Wyden (D., Ore.) that would prohibit the Commerce Department from pronouncing and enforcing regulations, standards, or policies that impose government standards on the private sector by restricting export of encryption-enabled software.
S. 909	Secure Public Networks Act	Bill introduced by Senators John McCain (R., Ariz.) and Bob Kerrey (D., Neb.) to reduce some export restrictions on encryption technology and make misuse of key-recovery information a crime. Also proposed the creation of a voluntary domestic key-recovery system.
S. 2067	E-Privacy Act	Bill introduced by Senators John Ashcroft (R., MO), Patrick Leahy (D., VT), and Conrad Burns (R., MT). Lays out a pro-privacy approach to computer security. Promotes privacy by protecting use of strong encryption domestically without key recovery options for government eavesdropping, eases export controls on encryption technology, and strengthens protections from government access to decryption keys.

Bill	Name	Description
H.R. 695	Security and Freedom Through Encryption (SAFE) Act	Bill introduced as an amendment to title 18 of the US Code by Rep. Bob Goodlatte (R., Va.). Originally sought to relax export controls on encryption technology but became entangled in several different House committees. The House Security Committee approved the amendment eliminating export reforms, but the House Commerce Committee then substituted a different amendment, the Oxley-Manton amendment, that required software companies to provide a backdoor in all encryption software sold in the U.S. This amendment was subsequently rejected and a new amendment was approved that provided for the establishment of a center where industry and law enforcement officials would work together to resolve encryption issues.
H.R. 1903	Computer Security Enhancement Act of 1997	Bill introduced by Rep. F. James Sensenbrenner (R., Wis.) that provides for export exceptions for encryption technology when comparable technology is available overseas.
H.R. 1964	Communications Privacy and Consumer Empowerment Act	Bill introduced by Rep. Edward Markey (D., Mass.) that includes provisions concerning encryption that prohibits the federal and state governments from restricting or regulating the interstate sale of encryption and conditioning the issuance of certificates, or authority on key escrowing and private key sharing, or the establishment of licensing or other regulatory schemes as a condition of regulatory approval.
	Computer Security Act of 1987	Established the Department of Commerce through the NIST to have primary responsibility for establishing computer security standards including encryption.
	Federal Telecommunications Act of 1996	Law that restructured competition and regulations affecting local and long distance telephone service, telecommunications equipment manufacturing, cable television, radio and broadcasting, and the Internet and online computer services.
ITAR	International Traffic in Arms Regulations	Federal regulations administered by the U.S. State Department treating encryption technology as a munitions subject to strict export controls.
EAR	Export Administration Regulations	Federal regulations administered by the Commerce Department. Authority for non-military encryption export was transferred from the State Department's ITAR to the Commerce Department under EAR.

Changing laws at all levels of government will affect how EC is implemented in Iowa and throughout the country. This is the primary reason for conducting a "legislative scan" periodically to ensure that any laws affecting the use of EC in Iowa are identified and understood.

1.3 Potential EC Opportunities

In looking for potential EC opportunities within the State of Iowa, two main sources were used:

- Information offered in the compiled State of Iowa Information Technology Strategic Plan was reviewed. This information was sorted and categorized to display opportunities in a more visual manner.
- Surveys of various government agencies and representatives of private groups or associations were conducted. Information from those surveys was then used to illuminate current thinking regarding EC.

Viewing this converging information with our experience formed the basis for our recommendations to proceed to next steps.

1.3.1 IT Plan Mapping

Mapping the State of Iowa Information Technology Strategic Plan (State ITS Plan) Iowa has identified the following via various IT and agency level studies thus far:

- Agencies are incorporating and/or relying more upon automated document management systems
- Data warehousing will be the key to sharing traditional information silos
- Agencies are looking to publish more information and data via the Internet & Internet technologies
- Distributed data processing is becoming more prominent across the enterprise
- IT will increasingly be used to provide management tools and information
- Geographic Information Systems will be used in conjunction with federal and local entities
- Re-engineering of business processes will be enhanced and pushed by IT
- Regional and agency level data is viewed as more critical to the enterprise-wide decision making process
- IT is becoming a more critical and integral part of each agency's means of delivering services
- IT has traditionally been segmented and "siloed". A more enterprise-wide notion of funding and supporting IT initiatives is underway

The goals of Governor Terry Branstad's Executive Order creating the Office of Information Technology Services (ITS) are:

- Promote an enterprise approach to organizing, managing and funding information resources
- Establish a statewide architecture with policies and standards that support an open systems, non-proprietary, standards-based environment
- Ensure contemporary information technologies and efficient approaches to application development and maintenance
- Provide access to information regardless of location or format
- Manage the shared resources that support the enterprise

Interpreting the ITS Strategic Project Map

The ITS Strategic Project Map (Map) identifies by agency and solution-type those projects (1) on the slate currently; (2) those in a 1-5 year window; and (3) those that are more long-term in planning. The chart also identifies projects that are specifically stated in the ITS Strategic Plan. Two primary sources were used in the development of the Map: the ITS Strategic Information Technology Plan and The Electronic Commerce Work Group document dated December 20, 1996.

The Map brings to light several key observations of the current IT strategy. These observations identify the need for planning of resources, technology and processes. Specifically the Map identifies the "critical needs" areas for people and technology skill sets. In summary the Map highlights:

- Solution areas that are most important to the Agencies
- The timing in which projects are expected to take place
- Technology areas where defined skill sets are most needed
- Technology areas where human resources will be needed the most
- The agencies that will demand the most of ITS
- The agencies that will require on-staff skilled IT practitioners
- A picture of the current IT resource demands
- A picture of the 1-5 year IT resource requirements
- A map to identify agencies seeking similar solutions, thus enabling collaboration and pooling of financial and human resources
- A picture of the more long-term plans by agency

Agencies with Aggressive Short-Term IT Strategies

In reviewing the Map, five agencies were identified as having aggressive IT goals. Each agency specifically listed 10 or more projects which involve multiple EC solutions and mixed technology skill sets. Gaining the skill sets and implementing the diverse EC solutions come to the surface as being the two most critical elements to these groups in meeting the ITS Strategic Plan objectives. Fortunately, most of the mission critical projects identified can be piggy-backed upon existing LAN/WAN technology. Projects such as web-site development & deployment, data warehousing and e-mail/listserv are easily implemented with little constraints on existing resources. The most aggressive agencies are:

- Agriculture & Land Stewardship
- Cultural Affairs
- Information Technology Services
- Natural Resources
- Public Defense

Most popular EC Solutions

The most popular EC projects require little staffing and resource allocation changes. Each of the popular solutions relies upon a sound LAN/WAN environment. The solutions are:

- Generic IT Management systems (i.e. backbones to data warehousing and information publishing)
- E-mail
- Specific internal process oriented opportunities like automated HTML-based timesheets
- E-mail and Listserv functions
- Online training manuals (CBT Training)
- Gaining outside Internet access via an ISP or dedicated line
- Information publishing
- Web-site development

Assessing the 1-5 Year Plan

Ongoing current initiatives total 44 major projects. In 1 to 5 years, there are 108 projects identified with the bulk in web-site development, improving internal processes, and implementing Information Management systems. In surveying several agencies in the state, it appears that most of the resources required reside in each agency, however, when dealing with process-oriented solutions and installation of Information Management systems, ITS retains the lion's share of resources required. The most popular EC solution areas were:

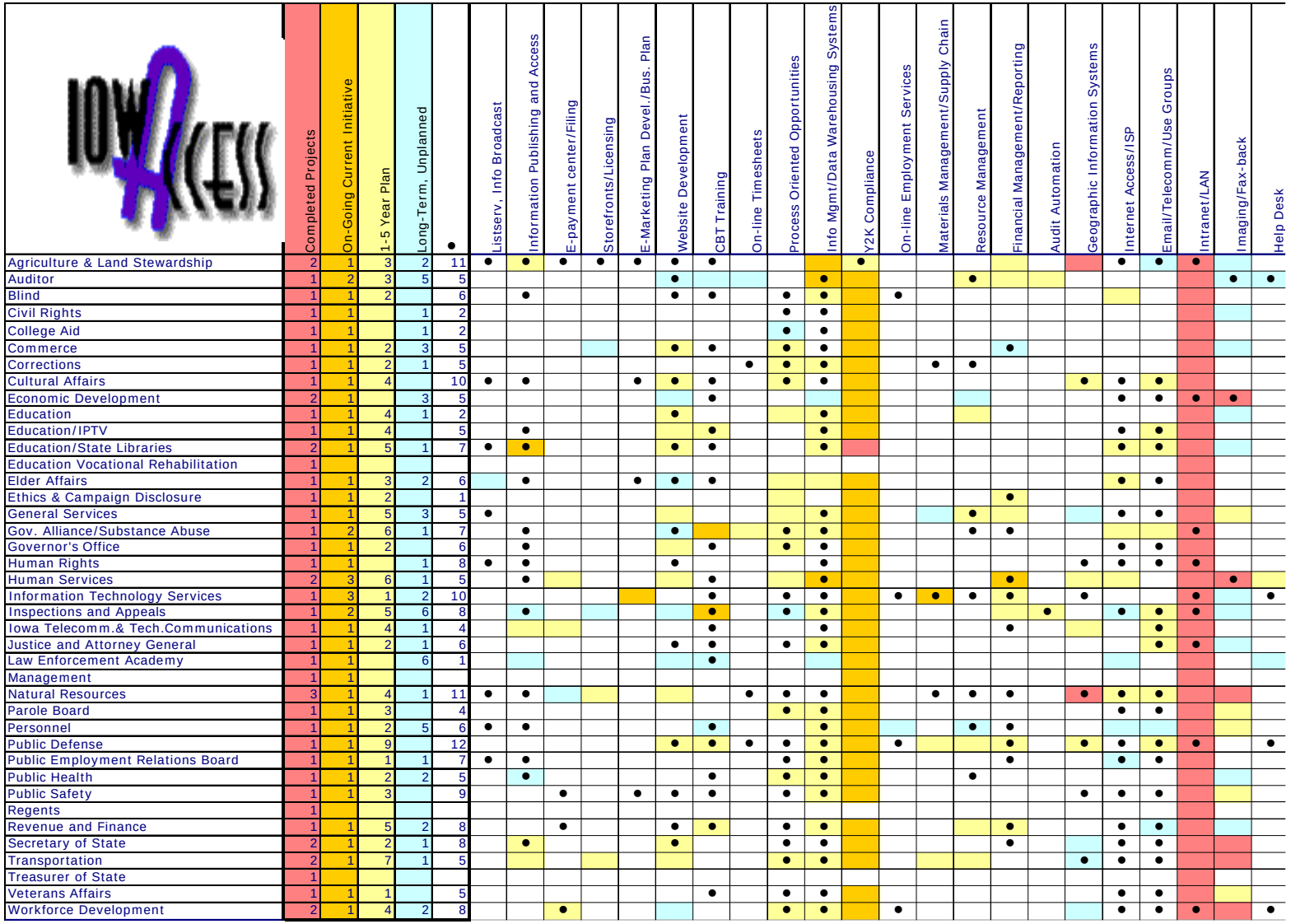
- Installation of IT Systems and Data Warehouses
- EC-enabling Internal Process (such as HTML-based time reporting)
- Installation of e-mail and ListServ processors
- Obtaining Internet Access via ISPs or dedicated lines
- Providing online training and help FAQs
- Publishing public information and providing access via web-enabled channels
- Developing agency web-sites

Quick Strikes

Many of the projects identified as most important to the agencies can be solved with little resource drain by ITS and other dedicated agency resources. These could be considered quick hits. More importantly, since the solutions mentioned above were popular with most agencies, there is room for collaboration and economies of scale. For the most part, the solutions above are replicable. If an installation works well, efficiency is gained by implementing a near duplicate.

With ITS' guidance, obtaining an ISP or installing a dedicated leased date line can easily be done with a local telecom interest. Installing e-mail servers and Listserv processors requires only having a basic network configured, dedicated server space and processing time to handle the traffic. According to the ITS Strategic Plan, most agencies, if not all, have intranets/LANs/WANs in place today to house e-mail servers. Providing online training is as simple as providing an online chat room staffed with helpdesk personnel, or providing interactive online FAQ forums.

Two of the solutions deemed most important by the agencies require little involvement of ITS. Publishing public info and developing web-sites go hand-in-hand. By developing the platform (web-site, in this case), publishing information to the constituents of Iowa is in the agency's control. Two important factors, however, will require ITS involvement: (1) security and (2) standardization of interactive technology deployed to access the public information. Additionally, breaching pending laws of privacy in information divulgement should be a concern high on the list of all who consider publishing agency-specific "public" data.



	Completed Projects	On-Going Current Initiative	1-5 Year Plan	Long-Term, Unplanned	●	Listserv, Info Broadcast	Information Publishing and Access	E-payment center/Filing	Storefronts/Licensing	E-Marketing Plan Devel./Bus. Plan	Website Development	CBT Training	On-line Timesheets	Process Oriented Opportunities	Info Mgmt/Data Warehousing Systems	Y2K Compliance	On-line Employment Services	Materials Management/Supply Chain	Resource Management	Financial Management/Reporting	Audit Automation	Geographic Information Systems	Internet Access/ISP	Email/Telecomm/Use Groups	Intranet/LAN	Imaging/Fax-back	Help Desk
Agriculture & Land Stewardship	2	1	3	2	11	●	●	●	●	●	●	●				●							●	●	●		
Auditor	1	2	3	5	5						●				●				●								●	●
Blind	1	1	2		6		●				●	●		●	●		●											
Civil Rights	1	1		1	2									●	●													
College Aid	1	1		1	2									●	●													
Commerce	1	1	2	3	5						●	●		●	●					●								
Corrections	1	1	2	1	5								●	●	●			●	●									
Cultural Affairs	1	1	4		10	●	●			●	●	●		●	●							●	●	●				
Economic Development	2	1		3	5							●											●	●	●	●		
Education	1	1	4	1	2						●				●													
Education/IPTV	1	1	4		5		●					●			●								●	●				
Education/State Libraries	2	1	5	1	7	●	●				●	●			●								●	●				
Education Vocational Rehabilitation	1																											
Elder Affairs	1	1	3	2	6		●			●	●	●											●	●				
Ethics & Campaign Disclosure	1	1	2		1															●								
General Services	1	1	5	3	5	●									●				●				●	●				
Gov. Alliance/Substance Abuse	1	2	6	1	7		●				●			●	●				●	●					●			
Governor's Office	1	1	2		6		●					●		●	●								●	●				
Human Rights	1	1		1	8	●	●				●				●							●	●	●	●			
Human Services	2	3	6	1	5		●					●			●					●						●		
Information Technology Services	1	3	1	2	10							●		●	●		●	●	●	●		●			●			●
Inspections and Appeals	1	2	5	6	8		●					●		●	●						●		●	●	●			
Iowa Telecomm.& Tech.Communications	1	1	4	1	4							●			●					●				●				
Justice and Attorney General	1	1	2	1	6						●	●		●	●									●	●			
Law Enforcement Academy	1	1		6	1							●																
Management	1	1																										
Natural Resources	3	1	4	1	11	●	●						●	●	●			●	●	●		●	●	●				
Parole Board	1	1	3		4									●	●								●	●				
Personnel	1	1	2	5	6	●	●					●			●				●	●								
Public Defense	1	1	9		12						●	●	●	●	●		●			●		●	●	●	●			●
Public Employment Relations Board	1	1	1	1	7	●	●							●	●					●			●	●				
Public Health	1	1	2	2	5		●					●		●	●				●									
Public Safety	1	1	3		9			●		●	●	●		●	●							●	●	●				
Regents	1																											
Revenue and Finance	1	1	5	2	8			●			●	●		●	●					●			●	●				
Secretary of State	2	1	2	1	8		●				●			●	●					●			●	●				
Transportation	2	1	7	1	5									●	●							●	●	●				
Treasurer of State	1																											
Veterans Affairs	1	1	1		5							●		●	●								●	●				
Workforce Development	2	1	4	2	8			●						●	●		●						●	●	●			●

Legend:

● Expressly stated in the Information Technology Business Plan

Completed project

On-going Current Initiative based upon the Information Technology Business Plan

1-5 year Initiative based upon the Information Technology Business Plan

Long-Term, unplanned future Initiative based upon the Information Technology Business Plan

1.3.2 Survey Results

Private Associations

Those surveyed interacted with government agencies across Iowa on the state, county and local levels. Courts and judicial agencies provided access to legal information. Departments from statewide financial and business regulators provided information and required filing of various documents.

Information included licensing and registration, tax reporting, legislative issues, and judicial case tracking. Associations obtained information from third parties such as driver information. Most of the information was passed in the form of paper documents.

Envisioned changes in the next few years could impact how these groups interact with the government agencies. More electronic transfer of data on licensing and permits is foreseen. Inter-government coordination such as the Intelligent Highways (I35, from Canada to Mexico) with the ports having pre-clearance of cargo is seen as the way to do business. Expanding existing means of business rather than reinventing the wheel is important. For example, utilizing existing banking/ATM systems to funnel transactions such as bonding, funds transfers and encryption makes sense.

Additional changes involved perceived response times from governments. The ability to interact with government in a timely manner appears to be falling behind with private industry offering services and information on the Internet. Expectations to dial up and get answers quickly are increasing.

Limitations in dealing with these government agencies continued this trend. Finding the right person, the hours that person was available and the use of paper to transact was a concern. Being able to get and file documents in electronic formats was seen as a timesaving necessity. Paper environment was labeled a problem. The trail of voice mail inquiries was a poor alternative to the perceived ability to track electronic inquires and delivery of same. This would allow a measurement of responsiveness.

Alternate sources of information were discussed. Current Internet methods such as Call Reports through the FDIC were great, but the information age of 90 to 120 days behind was not acceptable. The ability to search information in a timely manner was needed, but had a price. One example was a situation where it was cheaper to pay a person to stand in line at the DMV to get an in-person response to a driver inquiry at $2.50, than to pay a $5.00 fee for a direct electronic inquiry.

Procedural and decision matters can be obtained elsewhere in a timely manner. Unemployment information, Workman's compensation, bimonthly Administrative Procedural rules, regulations and sales data on the Internet were offered as examples of how quickly some information can be distributed.

The discussion on electronic standards was addressed on a policy vs. technical level due to the background of participants. Standardized licensing schemes between states were mentioned. An in-place backbone for Digital/Electronic signatures was mentioned through the Federal Reserve System and EDI. A federal bill standardizing financial messaging through ISO 85-83 and possible convergence with data and the ISO message set was of interest to a participant. Access to data and the use of secure web browsers was of importance, with a variety of industry standard software offered in expected proportions.

Current EC projects planned or underway had issues with connectivity. Linking web pages, connecting e-mail and developing Intranets to get information moving between government departments were current initiatives. Concern with the potential for a number of transaction keys being issued by various parties was expressed. (Do you need to plan for one key with the Federal government, one with a number of State departments, and possible third party or others?) Getting and publishing information was active.

Major update plans were standard upgrades of commercially available software products, and the creation of private networks.

A wide variety of information was not available. Information on legislative status, Workman's compensation claims, unemployment claims, and others were mentioned. A number of responses concerned the ability to get child support information, whether transacting business on weekend hours or when clearing titles. Calls for routine requests were not returned for periods of days to weeks. Given the dispersion of population and business throughout the state, electronic means to deliver services such as filing and receiving documents were important issues. Access to records from local governments and counties were also issues in the same areas.

In conclusion, while some respondents disagreed on some issues, many areas were pointed out for review. Uniformity, efficiency and low costs summed up the key elements desired by participants. Openness of communications and access when needed were stressed. Lengthy documents affecting a court decision should not arrive an hour or less prior to session. Automated inquiry methods could free up human resources to do exception work, rather than the routine. The development and use of statewide networks for business use was asked about. Openness to ongoing developments was encouraged.

In the area of customer service and competition, a number of departments and agencies were praised for their efforts. Others were castigated for adversarial relationships. To accomplish the desired cooperative and collaborative working environment, all parties should review how they interact with their customers. These customers are the reason for their continued existence.

Government Agencies

Twelve agencies were contacted and participated in a survey. Agencies contacted were:

- Iowa Workforce Development
- Natural Resources
- Public Health
- Agriculture
- Economic Development
- General Services
- Secretary of State
- Judicial Courts
- Revenue and Finance
- Commerce
- Human Services
- Inspections and Appeals

Participants were asked questions about customers, vendors, suppliers, resources, infrastructure, information, budgets and other items.

As expected, the diversity of participants covered a wide range of economic and business activity. Common themes did surface throughout.

The definition of **customers** expanded as a result of the survey. Internal and external customers were identified as well as the general public, other agencies of government, other governments and their entities, the business community and various strata of organizations such as professional groups, regulated businesses and others. Customers extended beyond borders, as the federal government and citizens/businesses of other states were often mentioned.

Customers' changing needs were anticipated. More universal access to information and the streamlining of products and services with easier tools to gain access were considered. There was concern as to how to get information to non-residents, in both organized business competition such as filmmaking, and general population competition such as tourism. Input from their customers indicated that changes would likely be in level of sophistication as opposed to different services. Less bureaucracy was desired, with increases in timeliness and efficiency of responses.

New groups of potential customers were seen. Most were intergovernmental agencies which could use information that the respondents had, growing Federal agencies and requirements as well as other states.

Transaction volumes were expected to continue growth at a rapid pace, while the cost to provide transactions would need to be competitive. With the expected stability in budgets, changes in case loads or activities would have to be met with new service delivery methods. Current staff levels would not be able to support this growth without process changes.

Products were widespread from supporting job seekers, various forms of permits for business and recreational usage, business support such as document handling and purchasing, information publishing needs such as regulatory assistance and decision status reporting, asset management and others.

Some new products were mentioned, but the volume took a back seat to the new delivery mechanisms and bypassing intermediaries to reach actual end customers. The general public's acceptance of self-service has offered an opportunity to deliver electronic services through the Internet or Interactive Voice Response Systems.

New products often repackaged existing information for a different client base. Regulatory information could be expanded to become competitive rate and service information to consumers, as may be possible with utility deregulation. New information and education on the information's implications was mentioned as requirements.

There was knowledge about the reuse of one's product, but the desire or ability to compete was not apparent.

Competition was the next common theme. New competitors were seen as private entities who might provide less expensive services as an outsource alternative. The need to benchmark the cost of providing services was mentioned. Competition was thought to have a chance to succeed if service differentials became widespread and known. The ability to deliver faster information with some product customization such as portions of maps were seen as areas of vulnerability.

Product differentiation was still viewed mostly as statutory monopolies. Legally certified documents and other similar services were seen as preventing competition.

Vendors and **suppliers** covered constituencies such as Federal and other levels of government. Much information is passed in document form up and down the government chain from local through Federal levels. Business entities and regulated professions were major groups who supplied information through various filing requirements.

Most information was manually recorded, and was then summarized and filed for retrieval and reporting. As expected, the main difficulty was in the timely retrieval of the information requested. This cuts through inconvenience through safety delays such as getting more information to patrol cars quickly.

Methods of partnering with vendors and suppliers were explored. The desire to work on pilot programs and sharing development costs were viewed as positives. There was resistance to partnering activities as ownership of process and data caused concern. Agencies were happy to share information. The pattern seemed to be sharing information with similar agencies, and not those entities supplying services and data.

Delivery systems compromised the next group of questions. Most processes were paper based. While electronic means such as EFT, fax, and web-sites were mentioned, the majority relied upon paper documents either delivered in person or through the various mail systems.

The limitations expressed revolved around timeliness. Office hour restrictions were a problem. Internal mail was viewed as a limitation, and difficulties in response to phone inquiries were expressed.

It was felt that customers were quite ready to accept self-help/self-service. Non-confidential information should be on web-sites in an easy to find format. Customers were still concerned about technology have-nots. But processes in general needed to be improved.

EC-related projects and initiatives were underway, as confirmed in the State IT Strategic Plan document. Upgrades and standardized software led the list. Innovation was seen in the spectrum of successful replication of existing to new processes or agencies. The use of existing tools and networks was seen as quick solutions to offer help.

Resources were seen as a constraint. Funding issues often addressed the understanding for the need of basic supporting technology infrastructure. Application projects, which might get funded, may not justify the infrastructure expense required to deliver. Funding for training and adequate technical resources was in short supply. Legal constraints such as digital signatures were roadblocks.

Better ways to utilize current resources were sought. Internet access was seen as a productivity aid. More training in areas such as SQL were needed. Adaptation of standards across lines of government and industry were a solution, but not rigid control to stifle entrepreneurial initiatives. Partnering to share information and technical resources was desired. The drain from work on Year 2000 projects was limiting resource availability.

Infrastructure applications supporting agency business was divided between legacy mainframe systems to network-based solutions. Some were still based around current processes, while others bore little relation on how the business process matched the systems design. The ability to get information from some legacy systems in a timely manner had prompted duplication of some functions.

Integration between systems was seen as weak. Funding issues to improve shared applications or equipment was mentioned. Inflexibility of existing applications led to the use of spreadsheets and other solutions to perform needed reporting and inquiry functions.

Plans included switching between competing packages to replace mainframe functions with client-server solutions. Simplification and integration was desired where possible.

Information Inventories were explored. Significant amounts of data were kept on mainframe systems. Users were not sure of data purge policies affecting their data. Paper-based information was stored in a manner that made retrieval difficult and time consuming. If information was stored on-line, inquiries might be answered on the initial call. Such efficiencies would be welcome.

Integration with other departments for related data would be helpful. Someone starting a business would like to know about state and local requirements with as few inquiries as possible. Constituents often assume that agencies can meet all of their information needs. This is rarely the case.

Budget implications were always present. Supplying resources for systems needs were split between internal personnel and outside parties. Budget projections were mostly status quo or level for the next few years. The expenditure split between new development activity and maintenance items was weighted in favor of new development.

Single year spending constraints were cited as to why some short-term thinking was present. The need for more funds for improvements was expressed. It was hoped that some potential savings could be allocated towards funding the systems work needed.

In the area of **Partnering** and **Alliances,** the concept of sharing with others was accepted. Mainframe applications were most mentioned. Actual sharing of data outside of an agency was not thought of as such, but addressed as exchanging information.

Large customers or vendors to benefit in joint development was seen mostly interstate, where groups or consortiums of like agencies cooperated on some levels. Dynamic web-sites and linking were seen as ways to benefit from joint development.

Most agencies felt they would participate and use a web-site or clearinghouse arrangement regarding joint project development and standards. They would be a proactive partner, and felt sharing of resources and knowledge could benefit all.

Other comments were offered. Comprehensive EC planning to produce consistent web-sites was hailed by some and rejected by others. The desire to use standard platforms and other tools did not meet as much resistance. The availability of needed resources and funding was in question. The ability to have private enterprise participation in projects was seen as helpful.

In summary, people wanted to collect information quickly, save it for appropriate periods, and access it quickly to support their customers. Communal needs for standards and planning was seen as important. And yet reluctance to give up autonomous applications control stood out.

1.4 Best Practices and Standards

Best practices in Electronic Commerce are addressed in this section. Given the wide range of organizations covered in umbrella fashion by this plan, this effort documents successful industry standards, which may be adopted and improved upon in response to specific needs as they develop in this dynamic atmosphere.

Sections covered include: organizational, technology, security and performance and capacity planning considerations. Performance measuring is covered in each section where appropriate.

1.4.1 Organizational

During the formation of this document, many other states and governmental entities were researched and found to have similar sized IT budgets, requirements, and constraints. Since the challenges are similar, the solutions should extend beyond the public sector to consider what is transpiring in the private workplace as well.

Organizational Concerns

While technology is intimately linked to electronic commerce and an IT department should take responsibility for supporting the associated technology, EC should not be viewed as strictly within the IT domain. Many private-sector companies have created groups dedicated to the development, support, and management of EC business and applications. These groups have multi-disciplinary membership with representation from Marketing and Sales, Logistics, Information Technology, Accounting and Finance, and various departments throughout the enterprise. Since EC has enterprise-wide impact, the scope of these groups often extends to the organization as a whole and involves activities such as planning, design, development, procurement, education, support, and internal and external marketing.

Many concerns have been raised by organizations regarding inappropriate use of the Internet from company machines during working hours. It is crucial that a policy covering acceptable use of computer resources and the Internet is created and well published. This policy should include guidelines for e-mail content as well as detailing possible penalties for infractions.

Staffing

Given the wide range of organizations cooperating in this plan, there is no one solution to be offered. With the widespread use of technology creating more savvy users every day, certain steps make sense in the right situations.

Projects can be divided by static and dynamic solutions. In a static situation where an application can be plugged in and run, the purchase of a solution can be easier. The actual cost of implementation is known for funding purposes, and there is little impact on other projects or work. Internal resources can be devoted to the operations of such systems. The problem of creating knowledge in staff positions who then become bored with operations may be avoided. Dynamic solutions call for a new process of ongoing work, and may affect staffing needs down the road. This budget impact must be planned for.

Internal resources should be viewed as a vendor or provider like any other, and held to the same performance standards. Where it makes sense and a repetitive solution is offered, the creation of a technical organization may be warranted. Given some shortages of skilled IT personnel and the difficulties of staff retention in the industry, outsourcing in the short term is often an effective solution, and should be investigated where possible.

1.4.2 Technology

It is a difficult task to try to adopt only "best of breed" products since this is frequently a "moving target" due to the rapid pace of innovation in the information technology marketplace. However, by choosing standards-based, open system products that have proven themselves in industry, the risk of implementing an EC application on technology that will rapidly become obsolete or prove to be incompatible with other applications is mitigated. Microsoft Windows NT is rapidly gaining popularity as a platform for office automation, and is an emerging market leader in the workgroup and departmental computing arenas. Many organizations have implemented their enterprise electronic commerce systems on RISC-based platforms running a UNIX operating system. The scalability and performance of these machines makes them an ideal choice for supporting large-scale electronic commerce applications. They can handle the often computationally intensive applications and can scale up to handle increased processing and bandwidth requirements with little incremental cost. In addition, many firewalls and encryption engines are implemented on these platforms as well.

Any technology implemented for electronic commerce should adhere to the technology standards of the Iowa Government. Standards for information technology need to be created and published to the enterprise. If standards have not been established, then technologies used for electronic commerce including hardware, software and security should be considered in the development of technology standards.

Standards

Firewall

- Market leadership
- Current technology
- Java and ActiveX filtering at the firewall
- Virus scanning at the firewall
- Intrusion detection software
- Leading alternatives:
  - CheckPoint Firewall-1 v3.x
  - Sun Ultra platform running Solaris v2.x with all recommended patches

Authentication

- For Iowa government personnel: Two-factor authentication method (see "authentication" discussion in Section 1.3.3) when accessing internal resources from remote locations (adopt Federal standards if possible). SecurID card is a leading solution in two-factor authentication
- For public: Username and password authentication when needed (based upon application)
- Security standards and policy review on all passwords

Encryption

- For Iowa intergovernmental transmissions via public access network infrastructure: standards-based system utilizing 128-bit keys (adopt federal government standards if possible such as Fortezza)
- For transmission of sensitive information to and from the public: Secure Sockets Layer (SSL)

These standards should be periodically evaluated as standards are developed and new products become available. As new legislation is passed at both the State and Federal levels, policies and technology both may have to be modified.

Technology Selection Standards

Application Technology Platforms

The selection of application technology platforms (hardware, operating systems, systems software, networks and communications) and associated software (application development and maintenance, systems and network management) involves several decision variables, and can follow one of several analysis approaches.

One generally accepted approach is to take a top-down analysis of the information processing requirements, which proceeds as follows:

- An understanding of the desired end-state *business architecture* – the collection of business processes and the underlying organizational models required to perform these. Scope includes both internal processes as well as those which involve inter-enterprise process integration.
- Defining a *systems architecture* that supports this business architecture. This integrates various components of information systems, including hardware, software, data and people across multiple public and private sector entities, spanning processes, functions and geographical areas.

Systems architectures are complex entities involving several inter-related components that collaborate to deliver the required processes and functions. One approach to managing this complexity involves a top-down analysis of the systems architecture, by decomposing it into smaller, more manageable components: information, application, data and technology. These elements are depicted graphically in Figure 1 below.

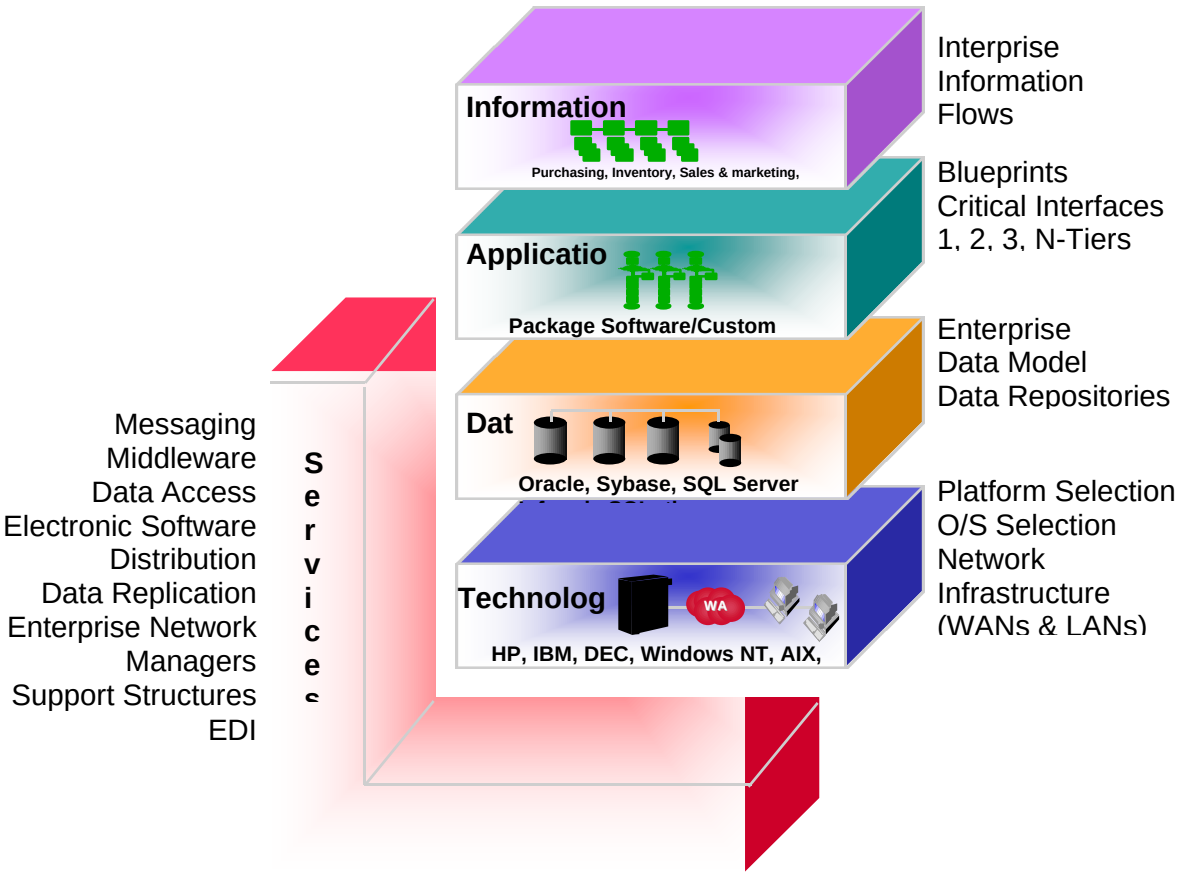


Figure 1 – Layered Approach to Architecture

The layered approach to architecture allows decisions to be made in a logical manner, and ensures that more detailed architecture decisions support higher-level requirements.

- The *information model* supports the business architecture, and provides the information needed to enable the process integration across enterprises. The notion of the internetworked enterprise (or "interprise") is introduced here. The information model includes key information entities (e.g., "taxpayers" or "employees"), and their composition, usage and ownership.
  - *Composition* describes the content and behaviors associated with these information entities
  - *Usage* describes the manner in which the information is used across the enterprise, and includes the various flows and paths information might take through a given process or function. For example, how revenue is collected from a taxpayer, recorded and ultimately redistributed back as goods and/or services. Usage descriptions will often have at least two dimensions: syntactic (specification of form) and semantic (specification of meaning). Usage also includes a mapping to the organization structure, within and across enterprises, roles and responsibilities of each user, and the underlying controls that enable these.
  - *Ownership* is related to usage, and models the various manipulations and transformations an entity takes, as well as ultimate ownership, storage and integrity of the entity's information through its lifecycle.
- The *application model* supports the information model. The application portfolio identifies an overall blueprint, defines the critical information perforations, and a high-level "tier-ing" – application decisions will drive some of the required data and technology architectures, particularly as they relate to distributed display, data, and processing. The application portfolio encompasses both existing legacy applications, as well as any new or planned applications. *The application model works in conjunction with the data model to manage the integrity of the data based on requirements in the information model.*
- The *data model* supports and enables the storage, processing and flow of information entities. It transforms the dimensional requirements of composition, usage and ownership into models that can be logically and physically modeled using database technology. The prevailing models today espouse a combination of relational database technology for the majority of transaction processing applications, and a combination of alternative models (flat, object, object-relational, network, hierarchical) to support specialized information requirements (e.g., knowledge management, complex queries and analytics).

- The *technology model* supports the application and data models. The technology model includes hardware, systems software, and various application infrastructure components. The sections below describe each component and provide additional detail. *A more in-depth component review can be found in the Appendix. This includes design requirements and criteria, and an analysis of currently available alternatives.*

  - *Hardware* includes physical computing devices (processor units and memory), storage devices (typically a combination of magnetic and optical disk and tape devices), network connectivity (routers, hubs, gateways and cabling) and various support infrastructure (operator consoles, power, cooling). A common approach to distributed computing is to categorize hardware in terms of processing tiers:

    - Presentation/user – responsible for all aspects of user interaction. Includes all user terminals (intelligent workstations through dumb terminals) input (keyboard, pointing device, phone) and output devices (video display, printer)
    - Application/business logic – responsible for processing user and system requests in accordance with a given set of rules that govern the business
    - Data – responsible for storage, retrieval and management of information

    Note that these tiers may be co-located on the same physical platform, depending on the architecture in use. The presentation tier is largely driven by the physical/geographical locations of the users and constituents.

  - *Systems software* includes the core operating software elements such as operating systems, database management systems and communications and messaging software. In the diagram above, these are also depicted as "Services"

  - *Application infrastructure* components include the various support services that are required to support, operate, maintain and enhance an application portfolio. These include application development elements (analysis and design tools, coding and testing tools, code and configuration management tools), and ongoing operations management elements (systems and network management, helpdesk, call center, report distribution, backup/restore and vaulting, disaster recovery).

The remainder of this section will focus on systems architecture components of specific relevance to Internet and Electronic Commerce applications. These include: Web Browers and Servers, Application Development, Web Server Integration, Database Integration, and Inter-System Integration.

Web Browsers and Servers

The core components of a web application are a browser, a server and a protocol. A browser is a client application that displays a page (a "web page") of text, annotated or marked-up using a standard language (HTML – HyperText Markup Language). A web page often embodying some content, a combination of plain text and one or more embedded data types that a browser can display -- graphical images, sound, video, etc. A web server is an application that receives user input (typically a request for a page, or some input data submitted), processes it, and redisplays the output as a new or updated page. A protocol is the established channel that allows the browser to communicate with the server – the most common one is http (hypertext transfer protocol), a simple IP-based protocol that allows the request and transmittal of hypertext pages.

The elements of a typical minimum Internet application environment are shown in Figure 2 below.

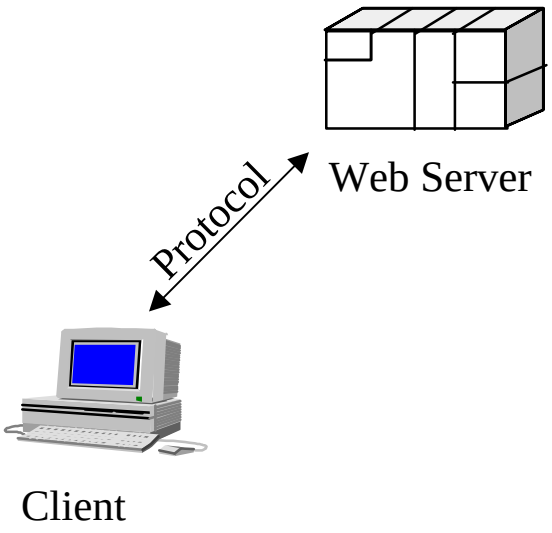


Figure 2 – Internet Application Components

Application Development

In the contemporary world of richer user interfaces and more sophisticated users, the "static" HTML page that characterized the first generation of web applications provides limited value today. Significantly greater value is provided with dynamic applications which can accept user inputs or requests, process them, and present or display the outcomes.

Dynamic content can be produced using one or more approaches:

- *Server-side processing* – application logic on the web server performs the necessary data accesses, application requests and formats the results onto browser-displayable content.

  Pro: Allows a more powerful machine to service user requests, less bandwidth intensive on startup; simplified administration and maintenance; supports a more flexible range of client browser platforms

  Con: Potentially more bandwidth intensive once operating; can result in a "least common denominator" constraint on application functionality

  Guideline: May be implemented using one or more of the integration mechanisms (CGI, proprietary API, SQL), using both interpreted (e.g., PERL, shell/script, Java or Visual Basic) and/or compiled (C, C++, COBOL) languages. A recent trend towards "application development frameworks" that simplify these tasks – leading vendors include NetDynamics, Netscape (Kiva) and Apple (NeXT WebObjects). The additional outlay associated with these tools should be balanced against the productivity gain in development and maintenance operations.

- *Client/browser processing* – application logic on the web browser performs the necessary accesses and formatting, as well as responding to user input. The logic modules are typically downloaded as needed.

  PRO: Less bandwidth intensive once cached; improved response time

  CON: More bandwidth intensive on initial load; requires a suitably enabled browser; client resource footprint marginally higher

  Guideline: Java (Sun) and Visual Basic (Microsoft) are two of the leading implementation languages in this space. These tend to lend themselves to intranet environments, where there is a higher degree of control and predictability over a user's client browser/workstation configuration and available bandwidth. For Internet applications, users can be given an alternative, depending on the client configuration and speed of connection.

The creation of dynamic content will often involve access to one or more data sources, or communication/collaboration with other applications to achieve this. The following pages describe the key integration considerations for web servers, databases, and across applications.

Web Server Integration

As described above, the fundamental capabilities of a web server are often limited to page retrieval and transmittal to a browser. To accommodate more complex requests, such as the dynamic formatting of content, a web server will collaborate with one or more external processes or data sources. This is shown conceptually in Figure 3 below.

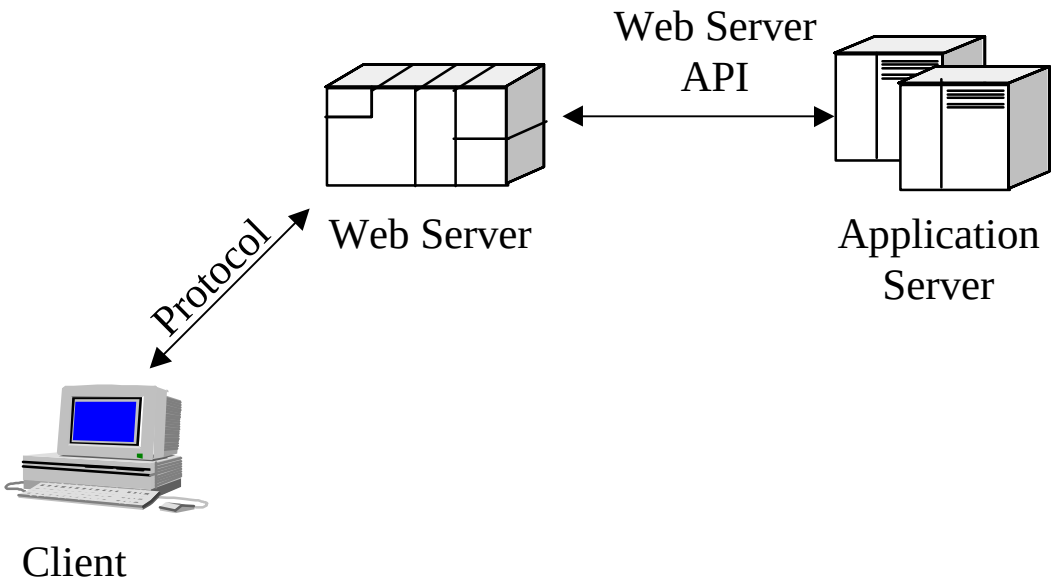


Figure 3 – Web Server APIs to Application Server

There are both open and proprietary approaches to establishing the interfaces to these processes and data:

- Open approaches include the original Common Gateway Interface (CGI), which allows a web server to communicate with an external process using standard I/O channels. CGI processes represent the "lowest common denominator" in web server interfaces, and are often the simplest and straightforward to implement. The trade-off is that they make inefficient use of server resources, particularly processes threads, and are inappropriate for high-activity environments. Several improved derivatives of CGI exist, often featuring faster, multi-threaded capabilities; these have not been adopted universally at this point.

- Proprietary approaches include vendor-specific approaches to communication, often built into specific web server products. Two of the more common ones include ISAPI (Internet Server API) from Microsoft and NSAPI (Netscape Server API) from Netscape. Both are specific to vendor web servers, and offer significantly improved performance and efficiency. The leading aftermarket web application server products have adopted both ISAPI and NSAPI as acceptable standards.

In the general case, the application server will need to access external data sources as well as inter-operate with external or legacy applications. The generalized integration framework is depicted in Figure 4 below.

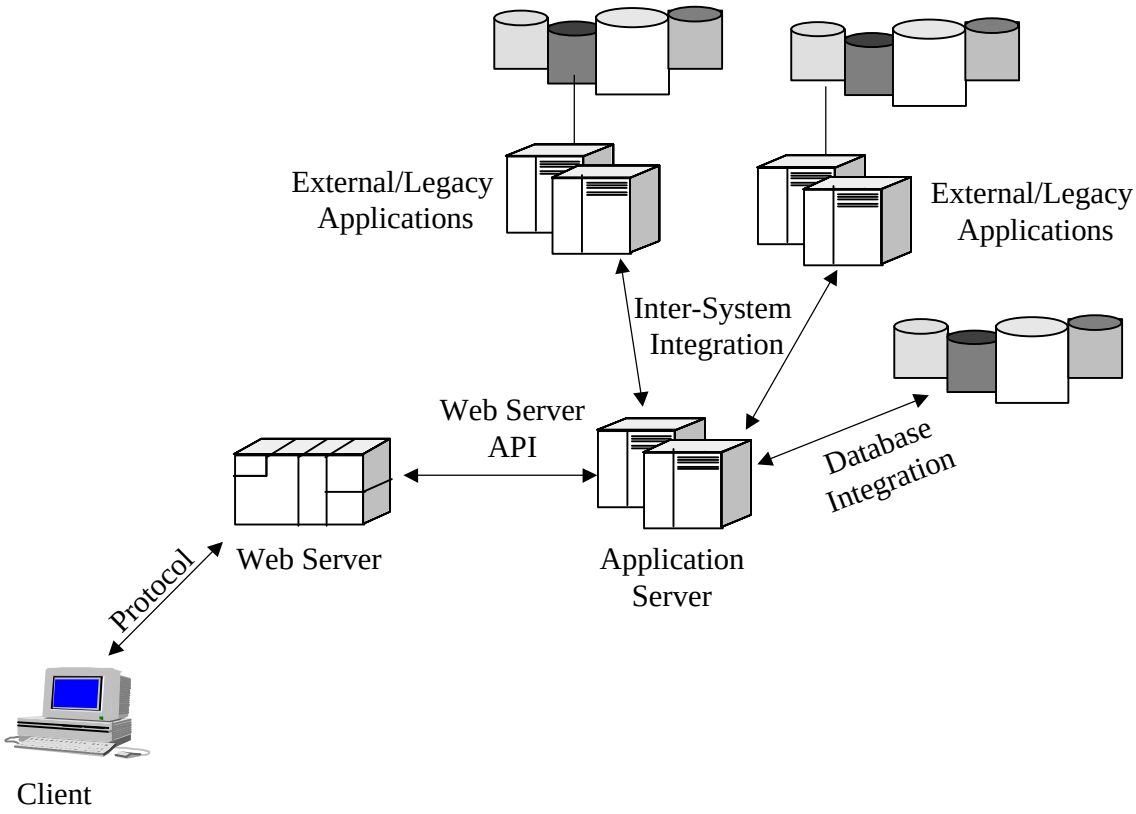


Figure 4 – Generalized Integration Framework

Database Integration – Applications will have to access data stored in potentially multiple back-end data sources, possibly involving multiple platforms and/or database management systems. This complexity can be mitigated using one or more approaches: use of standards such as SQL (structured query language), ODBC (open database connectivity) and JDBC (Java database connectivity – for Java environments). Finally, database middleware products have emerged in the past few years – these further facilitate database connectivity and access.

Pro: Use of standards promotes consistency in applications development and provides a common, well-defined interface to the data. Use of database middleware frameworks often provides simplified APIs to the data, and encapsulates the complexities of cross-platform multiple-database environments from the developer – overall with positive effects on ease of development and maintenance.

Con: Use of standards such as ODBC or JDBC might introduce some performance/resource overhead, compared to "native" access methods (e.g., Oracle SQL*net). Use of (ANSI) standard SQL does not leverage any proprietary performance and/or efficiency advantage of a given database management system. Database middleware frameworks are an extra-cost item and may introduce additional performance and/or resource loads.

Guideline: Use "standard" (ANSI) SQL if portability is important, taking advantage of OEM optimizations only where performance is critical. Review use of standard connectivity layers such as ODBC or JDBC (for Java environments) particularly if in a multi-database environment. Consider the use of database middleware frameworks (such as NetDynamics or Netscape's LiveConnect) when operating in a heterogeneous, multi-platform environment.

Inter-System Integration/Interoperability – To effectively interoperate in the heterogeneous computing environments in the typical enterprise or interprise, middleware has emerged as a solution component. Middleware is software that allows an application to interoperate with another while eliminating, or at least minimizing, the need to understand and encode the low-level operations of the respective host environments. In addition, middleware offers additional levels of scalability, recoverability and reliability.

There are several types of middleware products on the market today, each serving very different purposes. One classification of them is as follows:

- Asynchronous communication – asynchronous remote procedure call (RPC), publish/subscribe, message-oriented middleware (MOM)
- Synchronous communication – object request brokers (ORB), SQL-oriented data access middleware (described earlier) and synchronous RPC

Synchronous systems handle each request while the requesting system waits for a response. Asynchronous systems, on the other hand, fire off requests without waiting for responses, which are eventually returned in some indeterminate order – meanwhile the requesting system is free to perform other tasks.

There is an inverse relationship between scalability and recoverability. Synchronous middleware, often used in production online transaction processing (OLTP) systems, doesn't scale as well but is more recoverable. Asynchronous middleware, such as provided on the web, scales quite well but does not have any inherent recoverability.

A summary of the relevant middleware types, a brief description, typical usage, recovery and scalability, and the current market leaders, is outlined in the table below.

Type	Description	Usage	Recovery/ Scalability	Examples
Synchronous RPC	Message-passing facility. Connection-oriented.	OLTP applications	• Best recoverability • Poor scalability	• MTS (Microsoft) • Top end (BEA) • Encina, CICS (IBM) • Tuxedo (BEA)
Object Request Brokers	• Send objects and requests (messages) in an object-oriented system • Connection-oriented with location transparency.	Object-oriented environments	• Good recoverability • Good scalability	• ObjectBroker (BEA) • Orbix (Iona) • VisiBroker (Visigenic) • TIB/Objectbus (TIBCO)
Message Oriented Middleware	• Queue-based, store-and-forward messaging • Connectionless	Extended long-LUW processes and transactions	• Good recoverability (non-volatile queues) • Good scalability	• MQSeries (IBM) • MessageQ (BEA) • MSMQ (Microsoft) • XIPC (Momentum) • NEONet (NEON)
Publish/ Subscribe	• Event-driven, push-based facility • Connectionless	Applications that monitor and respond to selective events	• High Scalability • Medium Recoverability	• TIB/Rendezvous (TIBCO) • ActiveWeb (Active) • SmartSockets (Talarian)
Asynchronous RPC	• Requests issued without waiting on responses Connection-oriented	High-volume, low-integrity requirements	• Highest Scalability • Poorest Recoverability	• HTTP • RPC (NobleNet)

1.4.3 SECURITY

The security requirements for a potential EC application are of primary concern. The Government, both federal and state is often held as the scapegoat for grievances and makes it a popular target for malicious attacks. Iowa and other governmental entities must be particularly vigilant in detecting intrusions and protecting resources from attacks. In order to protect the privacy of users and limit risk and liability, sensitive information should be encrypted and internal resources must be protected from external threats. The requirements from the user end affect the access and usability of the application and the software and/or hardware requirements as well. Therefore, the State must ensure access to information and systems while maintaining security.

Questions for Evaluating Security Requirements:

- Do we need encryption from end-to-end?
- Does the user have to authenticate to access the information?
- Does the user need special software or equipment to access the application (private key, SecurID card)?
- Does the application have special security requirements (custom protocols/proxies or port access such as Oracle SQL*Net® ™)?
- Does the application conform to or require modifications to the established security policy (special access privileges such as time of day, day of week, password to execute certain functions, etc.)?

The standards for authentication and encryption are still evolving with many techniques and products competing to become the approved standard. When choosing products to provide security it is imperative that the solution adheres to industry standards and does not implement proprietary technology. This helps to ensure interoperability with other agencies and organizations. Access to external resources such as the Internet must be centralized to ensure a single point of access in order to protect internal resources. If some agencies have direct access to the Internet bypassing the enterprise firewall, then the efficacy of the firewall is diminished and security is undermined. This is analogous to locking the front door of a house and leaving the back door and windows unlocked. An option would be to implement multiple firewalls that adhere to an enterprise-wide security plan. Many firewall products allow centralized management. It is of critical importance that an information security plan is created that encompasses all levels of Iowa government. This plan should address issues such as access standards, acceptable use of IT resources, plan enforcement, virus control, actions to take when "attacks" or intrusions are detected, and disaster contingency and business resumption processes. Part of the access standards should be the protocols and services that are allowed and denied via a firewall. Table 1 lists some commonly used services:

Table 1: Allowed Services through a Firewall

Service	Port	Description
HTTP	80	Hypertext Transfer Protocol
HTTPS	443	Secure HTTP
SMTP	25	Simple Mail Transfer Protocol
POP2/POP3	109/110	Post Office Protocol
FTP (outbound)	21	File Transfer Protocol
NNTP	119	Network News Transfer Protocol

Certain services should also be proxied due to inherent security weaknesses and to provide additional protection. SMTP, HTTP, and POP are common protocols used and should be implemented via proxy services on a firewall. As an example, an SMTP proxy can compensate for security flaws in the standard Sendmail program. Rules should be created on the firewall that further restrict which machines a particular service may access. Inbound HTTP should be restricted to the web server that is designated for public access. This prevents outside users from accessing Intranet web servers. An alternative would be to force users to authenticate themselves before accessing an Intranet web server. Table 2 lists services that are typically denied since they pose a security risk.

Table 2: Disallowed (Denied) Inbound Services

Service	Port	Description
Telnet	23	Terminal Service
FTP	21	File Transfer Protocol
NFS	2049	Network File System
ICMP		Internet Control Message Protocol - used for transmitting error, control, and informational messages. Ping command uses ICMP
Finger	79	Used to obtain detailed information about users of a specified host machine such as login name, phone number, location, last login time, etc.)
Whois	43 63 4321	Protocol used to provide data about DNS domains and system administrators responsible for each domain
Traceroute		Provides network numbers and addresses of routers in the path to a specified host
Chargen	19	Character Generation
Rlogin		Remote Login
RSH		Remote Shell
SNMP	161/162	Simple Network Management Protocol

Some services may be allowed depending upon determined requirements. For instance inbound FTP may be allowed to a specific machine such as a public FTP server, or inbound telnet may be permitted to certain machines with user authentication. The approach adopted should be conservative in allowing services. This can be described as "that which is not explicitly allowed is denied" vs. "that which is not explicitly denied is allowed." The services listed in the denied table should be explicitly denied and trigger a message or alert since they can be signs of deliberate probing or an outright attempt at penetration.

Firewalls

A firewall is the first line of defense from external threats. A firewall consists of a machine with software that is designed to control access to internal resources from external sites. There are three major types of firewalls: Packet Filter, Circuit-Level, and Application Gateway (proxy server). Packet filters operate at the Internetworking level of the TCP/IP protocol hierarchy (OSI Layer 3 - Network Layer) and grant or deny access for a service (protocol) from a source address and port to a destination address and port, based on configurable rules.

Packet filters have historically been implemented on routers. The advantages of packet filters are that they are transparent to users, fast, and flexible. The disadvantage of packet filters is that they are stateless - meaning that each packet of information is examined independently of other packets that have been examined, and therefore are not aware of the context of communication. They are considered the least secure type of firewall. A superset of packet filtering firewalls are packet filters with stateful inspection. Stateful inspection means that the first packet in a connection is examined and compared to the rule set, if the packet is permitted the information, or state, is added to an internal database on the firewall and subsequent packets in that connection pass quickly through the firewall. Stateful inspection also looks at the packet's data section to gain information about the application protocol being transmitted. This adds the understanding of the context of communication that is missing from straight packet filtering firewalls. Check Point Software Technologies' Firewall-1™ is the most recognized firewall product using stateful inspection technology. The disadvantages to packet filters are that they do not look at the entire packet and are considered less secure than application gateways.

Circuit level firewalls act as an intermediary between two machines. They operate at the Session Layer in the OSI model (Layer 5) and similar to stateful inspection, refer to a state table of valid connections in determining whether subsequent connection attempts are allowed or denied. The advantages to circuit-level firewalls are the same as those for packet filtering firewalls: they are transparent to users and relatively fast. The disadvantages are that since they operate at the session level only, they still lack complete contextual information about connections and are prone to attacks that exploit application level weaknesses. SOCKS is a protocol for handling TCP-based traffic that can be adapted to a variety of applications and is a widely used circuit-level firewall. Application gateways or proxy servers operate at the top level of the OSI protocol stack (Layer 7 - Application Layer).

Application gateways maintain complete connection state and sequencing information. Inbound and outbound traffic is redirected via services on the firewall called proxies. This prevents direct access to services on the internal network. All outgoing traffic appears to originate from the firewall so internal addresses are hidden. Since an entire data packet is examined, application gateways provide greater security than other types of firewalls and a more granular level of logging. The drawbacks of application gateways are that their performance may be slower than other types of firewalls and depending on configuration, less transparent. Two of the leading application gateway firewalls are Trusted Information Systems' Gauntlet™ and Raptor Systems (Axent Technologies) Eagle™.

Many competing claims have been made by firewall vendors as to which product is most secure and uses the best technology. Stateful inspection firewall vendors claim that their firewalls are just as secure as application gateways, while application gateway firewall vendors claim that their performance is as good as those of packet filtering or stateful inspection firewalls. Sorting through competing claims is a daunting task. In regard to Iowa's needs a decision on which firewall to choose must be based on the level of security required, ease of management, flexibility, level of control, and price-performance, among other factors. Check Point Firewall-1® is the market leader among all firewall vendors in all categories of firewalls. Trusted Information Systems (TIS)™ and Axent (Raptor Systems)™ have application gateway firewalls that are comparable in features and price.

The classic firewall architecture is depicted in Figure 1 below. Access from the Internet must pass through a firewall before being transmitted to the internal network. The firewall has three network interfaces: one to the Internet, one to the internal network, and one for a third network segment typically called a DMZ for "de-militarized zone." The DMZ is where web servers, FTP servers, and other "public" servers are placed. The reasoning for this is that these servers provide information to the outside and while protected by the firewall are more vulnerable to attack since they interact with external machines. If one of the machines in the DMZ is compromised, the intruder is still not on the internal network and must infiltrate the firewall again to access the internal resources. The router to the Internet in Figure 2 is shown in dashed lines to indicate that it is a screening router (packet filter) and that the screening function is optional.

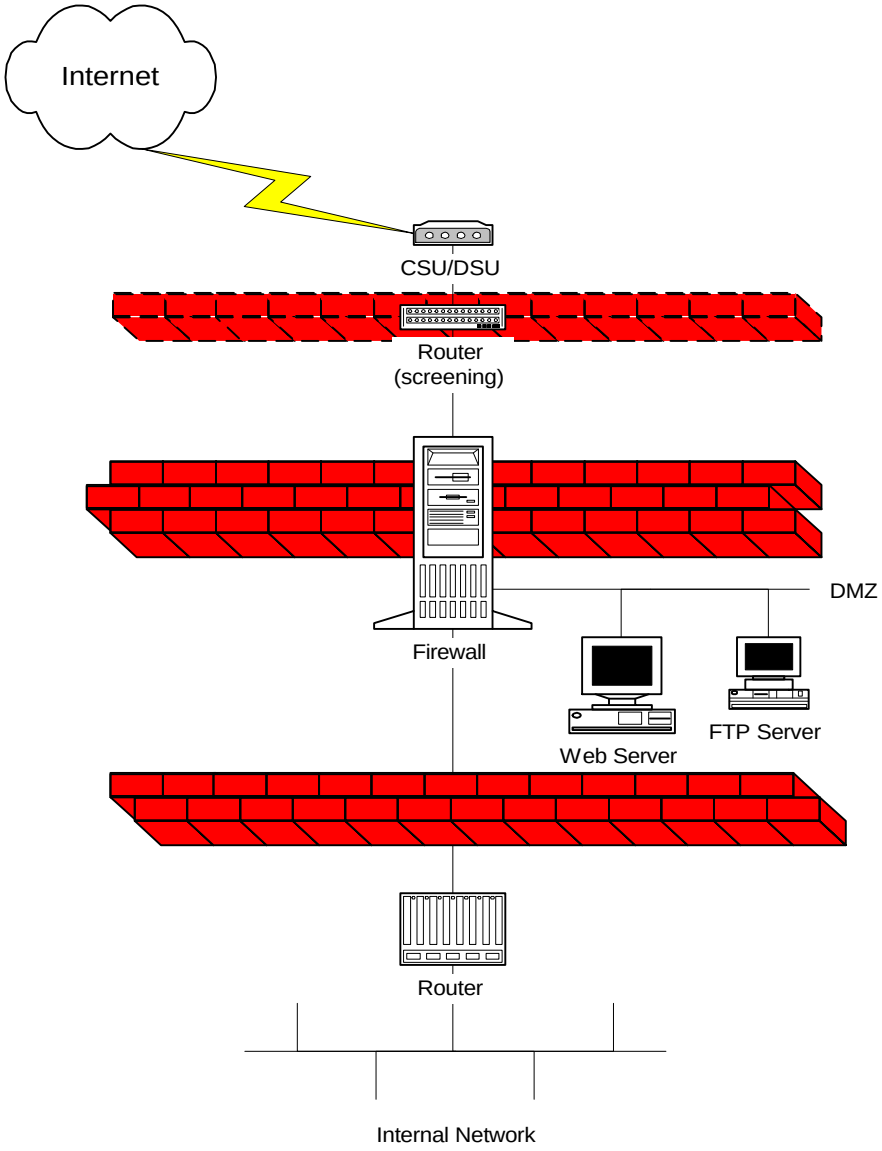


Figure 2: Classic firewall architecture

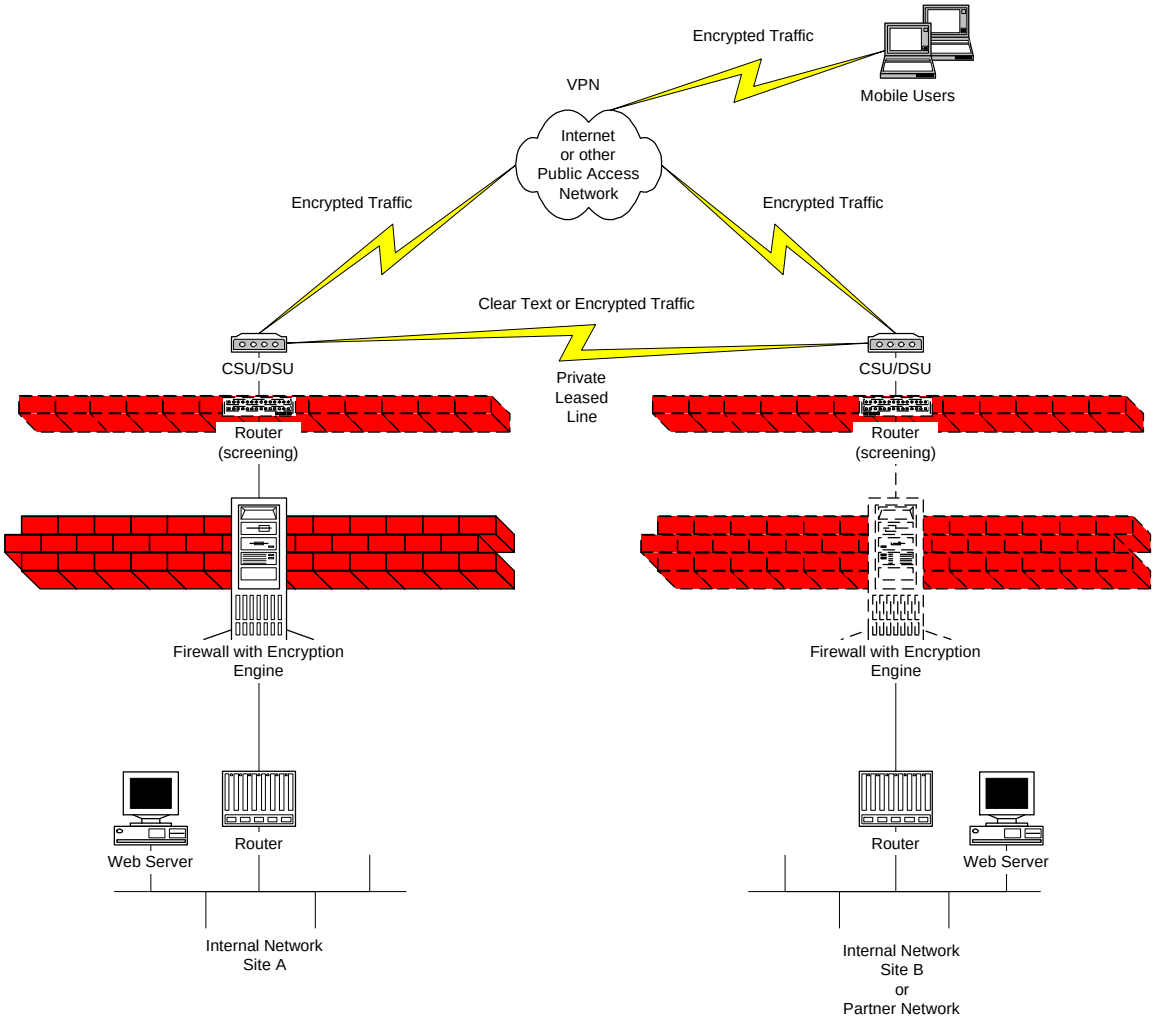


Figure 3: Extranet, Private Network, VPN

Figure 3 depicts an extranet, private network, and virtual private network (VPN). An extranet is a link with a partner or supplier. In Iowa's case this could be another governmental agency (local, state, or federal) or a private industry entity. An extranet can be implemented in a variety of ways. The traditional means of implementing communications between suppliers, partners, or remote company locations was via private networks with leased lines. Security was not as much of a concern since it was assumed that transmitted data was secure from prying eyes. With the advent of the Internet and value-added networks (VANs) such as IBM's Advantis, a new, lower-cost method of information sharing became available. The primary concern with using these public access routes is security since they potentially expose transmitted data to outside entities. To compensate for this, VPNs were created. The concept behind a VPN is simple, encrypt data that is sent via a public domain network which can only be decrypted at the intended receiving end. This results in establishing a private network via the use of public domain network infrastructure, hence the name virtual private network. In Figure 3, the same elements of a standard firewall architecture are used including a screening router. For simplicity, a DMZ configuration is not depicted. The firewall architecture for the remote site or partner organization's network is shown in dashed lines to indicate that they are optional and may not be in place in the case of a private network. A VPN implies that encryption is used, thus a firewall or other hardware or software encryptor would be in use at both ends and by remote users.

Firewalls can also be used to compartmentalize a network. For departments within an organization that deal with sensitive information such as human resources, it may be wise to segregate their LAN or segment from the rest of the enterprise network. Firewalls can be used to control and monitor access to this segment or specific machines within the segment. The firewalls could also be used to encrypt sensitive information. Figure 4 depicts a compartmentalized network. The firewalls are shown in dashed lines since they are optional. In an intranet environment where no sensitive data is stored or transferred, compartmentalization is not necessary. There can also be multiple departments that need to be secured and several firewalls may be used internally on the network.

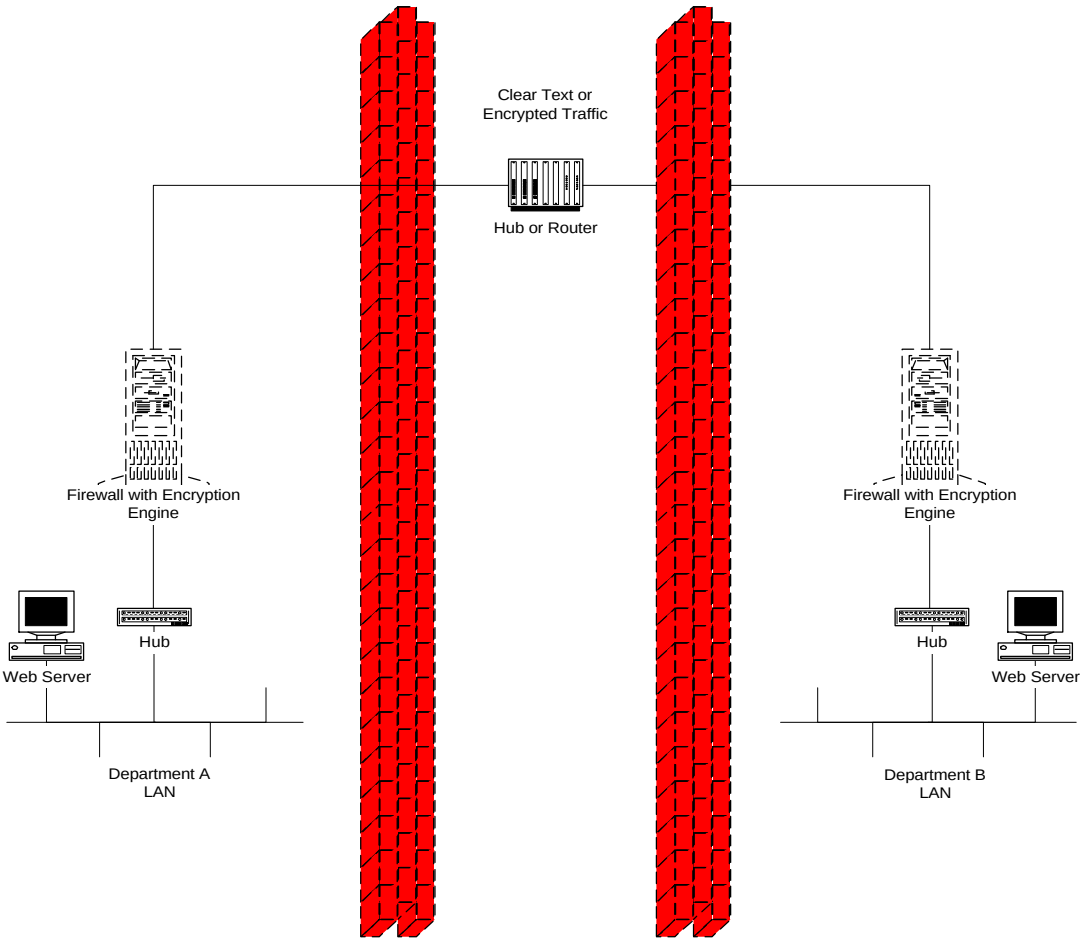


Figure 4: Intranet and Compartmentalized Network

Methods of Attack

Hackers have devised several methods of attack to gain access to restricted information and resources, or to cause malicious damage and denial of service. Some common methods are detailed below.

- **KeyStroke Monitoring** – monitoring of keys pressed on a keyboard to observe a password or other confidential information via direct observation or through the use of a program.
- **Social Engineering** – manipulation of people in order to gain information or access (i.e. posing as a member of a firm).

- **Brute Force** – attempting to guess passwords by running a "dictionary" program against an organization's authentication process or using a "crack" program that takes a file of words and uses the same encryption algorithm as the organization's authentication system to find a match for a password.
- **Network Monitoring** – monitoring or "sniffing" the packets on a network to capture passwords and data.
- **IP Spoofing** – sniffing network traffic to get an IP address or the range of addresses used by a company so that an external machine can be assigned an internal address and masquerade as a trusted resource to gain access and information.
- **Session Hijacking** - A type of IP spoofing attack in which a user's session on a machine is taken over.
- **Race** – the password data is monitored on the network and just before the last digit is sent, the attacker sends ten login requests to attempt to beat the real user and try all possible remaining combinations in order to hijack the login process.
- **Man-in-the-Middle** – a computer or computers are placed between a user and system using a one-time password. The packets are captured by the machine in the middle and transmitted as its own.
- **Exploit Attacks** - attacks that are targeted toward exploiting inherent weaknesses of operating systems and applications. A buffer overflow attack is an example of an exploit attack. Several applications such as Sendmail, Finger, and HTTP do not check to see if user input fits into the buffer allocated by the program. It is possible to send more data than the buffer can accept, overflowing the buffer. If the data sent is substitute code, it is possible for the attacker to gain control or unauthorized access to the machine. Several weaknesses in the Windows NT™ and various versions of the Unix operating systems have been well publicized. Software vendors publish periodic patches to fix discovered vulnerabilities.

- **Denial of Service** – an attack that is not designed to gain access to a protected resource but to prevent access to the resource by authorized users. Ping Of Death, SYN Flood, Land Attack, UDP Flood, Smurf Attack, Teardrop Attack, and Mail Bombs are several known methods of this type of attack. In the Ping Of Death attack a ping packet that is larger than 64K (the maximum allowed packet size of the IP standard) is sent. When a victim machine receives a packet of this size, it often crashes, reboots, or hangs. In a SYN flood attack, the IP standard's three-way handshake communications model is exploited. An attacker sends multiple synchronize requests (used to initiate establishment of communications between computers) and ignores the responses. The target machine is forced to acknowledge each request filling up its finite-sized backlog queue until it overflows and is unable to acknowledge any other requests. A Land attack is a variant of the SYN Flood attack in that the victim machine's IP address is spoofed so the system ends up talking with itself. A UDP Flood is similar to a SYN Flood attack in that a target machine's resources are tied up. A hacker connects one victim machine's UDP (user datagram protocol) chargen (character generation) service to another victim machine's UDP echo service. The two victim machines are then tied up in exchanging a flood of meaningless data. In a Smurf attack, a target machine's IP address is spoofed and a broadcast ping is sent on several subnets. The target machine is then deluged with ping responses tying up the victim machine as well as increasing the traffic load on the internal subnets that were pinged. A teardrop attack exploits the IP standard's packet reassembly process. An attacker sends packet fragments that have overlapping offset fields that make it impossible for the target machine to reassemble the packets properly tying up the machine in the process. A Mail Bomb is similar to a flood attack in that target machines are flooded with data, which ties up their limited resources. In a Mail Bomb attack, thousands of electronic mail messages are sent to a victim's e-mail address. A variant of this attack is to mass subscribe a victim to many mailing lists resulting in a deluge of e-mail messages.

Authentication

Authentication is used to prove a user's identity in order to gain access to restricted resources. Another reason for user authentication is accountability and non-repudiation. An organization is able to track which person or entity performed which action. Along with accountability comes liability. Companies have been proven negligent in protecting shareholder assets by not having adequate controls in place. Liability "downstream" has become an issue as well. An example of downstream liability is that a computer connected to the Internet is compromised and used for an attack that causes losses to a third party. Not only is the perpetrator of the act liable, but the intermediary organization whose computer was used (unknowingly or not) is also liable. In its simplest form, a username and password combination provides a method of authentication. Some common authentication terms and technologies are listed in the Table 3 below.

Table 3: Authentication Technologies

Technology	References	Description
Reusable and One-time Passwords		Provides single-factor authentication. Reusable passwords are considered the least secure form of authentication.
PAP	Password Authentication Protocol	Username and password method of authentication. Stored table of username-password pairs may be encrypted, but transmission over a network is in clear-text.
CHAP	Challenge Handshake Authentication Protocol	Similar to PAP except the authentication agent (server) sends the client program a key used to encrypt the username and password during transmission
S/Key		Public domain package to generate one-time passwords
RADIUS	Remote Authentication Dial In User Service	Distributed security utilizing an authentication server and client protocols. Encryption is used for authentication request and acknowledgement. Submitted to the IETF as a draft on distributed remote access security.
TACACS	Terminal Access Controller Access System RFC 1492	Industry standard protocol specification. Forwards username and password information to a centralized server that performs lookup and allows or denies connection.
Kerberos	RFC 1510	Network authentication protocol utilizing single-key encryption for confidentiality
SecurID		Two-factor authentication product. Uses a one-time pseudorandomly generated token code combined with user selected PIN. Tokencode is generated by a processor stored in a smart card.
Smart Card		Credit card sized device with a processor that generates a token or code. Generally time-synchronized with a server. Some implementations require a PIN to be combined with the token to form the passcode; others require a PIN to access the token from the card itself.

Although reusable passwords are frequently implemented as a means of authentication, they are vulnerable to several different attacks including keystroke monitoring, social engineering, brute force attacks, and network monitoring. One-time passwords are more secure than reusable passwords since they are different each time (usually used in conjunction with a token that regularly changes in synchronization with the server). One-time passwords require more ingenuity to defeat, but are susceptible to man-in-the-middle and race attacks. Single factor authentication methods such as reusable and one-time passwords are not considered a means of strong authentication. Two-factor authentication is currently the strongest form of authentication. It can be thought of as combining "something you know" (a PIN or password) with "something you have" (a token generated by a smart card).

Encryption

Encryption is the encoding or “scrambling” of messages that renders them unreadable unless they are decrypted. Encryption allows for a means of sharing data over public networks without the fear of unintended parties gaining access to the information. Firewalls protect internal resources from outside entities. Encryption protects data as it travels from sender to receiver. Encryption is closely related to authentication and both are commonly used to secure transmitted data as well as access to data. A mathematical key is used as the basis for an algorithm to encrypt the message. A different key is used for decryption and the decryption key cannot practically be derived from the encryption key. The number of bits or key length determines how secure the encryption is since the basis of encryption security is the difficulty in factoring large integers. It is possible to "break" a key by using a brute-force attack. The increasing power of computers coupled with their decreasing cost has made breaking encryption keys easier. 40-bit, 48-bit, and 56-bit keys have been successfully broken, but not without substantial effort. In a very well publicized event, a French student was able to decrypt a message that was encrypted with a 40-bit key using the RC4 algorithm. It required 120 workstations and two parallel supercomputers at three major research centers working for 8 days to accomplish the task. The cost of the effort was estimated at $10,000US[2]. This effort was required to break a single message. In order to break another message it would take another 8 days of 120 workstations and two parallel supercomputers. Using an RC4 128-bit key would require computing power 1,000,000,000,000[2] (one trillion) times greater than that which was used to break the 40-bit encrypted message. This would equate (using the same cost assumptions) to a cost of $5,600,000,000,000,000,000,000,000,000,000US[3]. In another well publicized event involving an Internet-based collaborative effort involving tens of thousands of people and computers, a message encrypted with a DES 56-bit key was broken. There are several different encryption technologies and algorithms, the most common are listed in Table 4.

Table 4: Encryption Technologies

Technology	References	Description
S/MIME	• Secure Multipurpose Internet Mail Extensions protocol • RFC2311 Version 2 Message Specification • RFC2312 Version 2 Certificate Handling	Proposed IETF standard utilizing digital certificates to authenticate sender and receiver, ensure message integrity, and ensure privacy of contents and attachments. Based on RSA's public-key encryption technology.
S/MIME	Biometric Authentication	The use of measurable biological characteristics for authentication. Fingerprint scanners and voice analysis are example techniques of biometric authentication.
PGP/Open PGP	Pretty Good Privacy	Program to encrypt and decrypt data transmissions and digitally sign messages and files. Utilizes public-key encryption (RSA for key management, IDEA for encryption, MD5 for hashing algorithm). OpenPGP is another IETF proposed standard competing with S/MIME.
PEM	• Privacy Enhanced Mail • RFC 1421-1424	System for providing secure electronic mail over the Internet. Includes DES-based authentication and DES and RSA-based key management. May be superseded by MOSS.
RIPEM	Riordan's Internet Privacy Enhanced Mail	An implementation of PEM. Utilizes both DES and RSA for encryption.
MOSS	MIME Object Security Standard	Proposed standard designed as a successor to PEM
SET	Secure Electronic Transactions	Proposed standards that utilize digital signatures for secure electronic transactions. Created form the merging of two other protocols SEPP (Secure Electronic Payment Protocol) and STT (Secure Transaction Technology). Supports DES and RC4 for encryption, and RSA for signatures and key management.
PCT	Private Communication Technology	System for secure communication on the Internet developed by Microsoft. Supports several key management systems including Diffie-Hellman, Fortezza, and RSA. Supports DES, triple DES, RC2, and RC4 for encryption. Supports DSA and RSA for message signatures. Companion to the SET protocol.
SSL	Secure Sockets Layer	A protocol for secure WWW connections developed by Netscape. Utilizes 128-bit key for encryption (40-bit key for international versions). Submitted to the IETF for approval as a standard. Implemented in many browsers.

Technology	References	Description
SHTTP	Secure HTTP	Another protocol for secure WWW connections. Designed to transmit individual messages securely. Submitted to the IETF for approval as a standard. Supports Kerberos and RSA for key management, DES, Triple DES, IDEA, and RC2 for encryption.
IPSec	Internet Protocol Security	Set of protocols developed by the IETF to support secure data exchange. Utilizes public keys and digital certificates.
WTS	• Web Transaction Security • RFC 2084	IETF Working Group to develop specifications to provide security services to web transactions using HTTP.
DNSSec	• Domain Name System Security • RFC 2065, RFC 2137	IETF Working Group to design enhancements to the secure DNS protocol.
Symmetric-key Encryption		Also called secret-key or single-key encryption. Encryption system in which a single mathematical key is used by the sender and recipient to encrypt and decrypt messages. The key must be exchanged between sender and recipient in a secure fashion.
Public-key Encryption		Also called asymmetric-key encryption. Mathematical two key system consisting of a private key that is maintained by its owner and a public key that is embedded in the digital certificate. When a message is encrypted with a private key, only the corresponding public key can decrypt the message and vice-versa. Differs from symmetric-key encryption in that the public key can be shared in a non-secure fashion (private key is never shared).
Digital Certificates		Authority of digital certificates backed by third-party Certificate Authorities (CA). CAs issue encrypted digital certificate containing an applicant's public key and other information. CAs publish their own public key so that they are accessible by the public. Recipient of encrypted message uses a particular CA's public key to decrypt the digital certificate attached to the message and verifies that it was issued by the CA. Recipient then obtains the sender's public key held within the certificate and can reply with an encrypted message.
Digital Signatures		A digital code that is attached to a message that uniquely identifies the sender. Encryption is used to prevent forgery. Digital key system protected by single-factor authentication password.

Technology	References	Description
X.509	• RFC 1825-1829 • RFC 2104 • RFC 2085	An ITU-T (International Telecommunication Union - Telecommunication Standardization Sector) Recommendation widely used as a standard for defining digital certificates. Pending approval as a true standard, many implementations are not compatible with each other.
DES/Triple-DES	Data Encryption Standard ANSI X.3.92	Symmetric-key encryption standard using a 56-bit key. Implemented in many operating systems for user authentication. Triple-DES uses three keys and multiple encryption/decryption passes over the message. The DES algorithm is becoming weak and is easily breakable with special hardware. Triple-DES is considered much safer than plain DES.
IDEA	International Data Encryption Algorithm	128 bit single key system used for both encryption and decryption. There are no practical published attacks against this algorithm.
Fortezza		Part of GOSIP (Government Open Systems Interconnectivity Protocol). Authentication/encryption scheme that uses a 56-bit key (minimum) based on DES to encrypt data. A token-based system is added to the authentication process. Users are assigned a smart card that stores the token code and is used in conjunction with a PIN. A card reader must be used to read the token from the smart card. Mandated as an Internet security system for federal agencies and contractors.
Blowfish		Algorithm that uses variable length keys up to 448 bits. Has been implemented in some applications. There are no known attacks against this algorithm.
RC2, RC4, RC5		Encryption algorithms for symmetric-key systems utilizing different key sizes
MD2, MD4, MD5	Message Digest Algorithm	Hashing algorithms used for digital signature applications. MD2 and MD4 have known flaws. MD5 is widely used but potential weaknesses have been reported.
SHA1/SHS	Secure Hash Algorithm 1 / Secure Hash Standard	Cryptographic hash algorithm published by the NIST. Considered to be fairly strong.
Elliptic Curve		Emerging field of public-key cryptography. Algorithms are considered fairly secure but have not been subjected to a great deal of scrutiny.

Technology	References	Description
RSA	Rivest, Shamir, and Adelman	Public-key encryption technology developed by RSA Data Security, Inc. RSA stands for the last names of the inventors. Uses very large numbers in an algorithm for generating keys. Has become the de facto standard for encryption and is used in many software products including Netscape Navigator and Microsoft Internet Explorer.
Diffie-Hellman		A commonly implemented public-key algorithm
SKIP	Simple Key management for Internet Protocols	Key management and exchange specification developed by Sun Microsystems
ISAKMP/ Oakley	Internet Security Association & Key Management Protocol	ISAKMP Sets framework for Internet key management and provides specific protocol support. Used in conjunction with session key establishment protocols such as Oakley. Oakley Key Determination Protocol utilizes a hybrid Diffie-Hellman technique to establish session keys on Internet hosts. ISAKMP and Oakley have been combined into a hybrid protocol that has been proposed as the key-exchange method for IPSec.
Photuris		Another proposed key management protocol standard
S/WAN	Secure Wide Area Networking	Proposed standard to provide for secure wide area networking using encryption and public-keys. Developed by a consortium of companies.
Capstone		Government Escrowed Encryption System. Utilizes an encryption chip with unique key. This key will be split with each half held by two federal escrow agents, the NIST and the Treasury Department's Automated Systems Division. Legal authorization will be required to assemble the key and decrypt intercepted information.
Clipper		Name of the chip used in the Capstone system. Utilizes the SKIPJACK algorithm
DSS	Digital Signature Standard	US Government endorsed and patented signature only mechanism. Has not been made public and potential problems with the system have been identified. Part of the Capstone system.
DSA	Digital Signature Algorithm	Algorithm used in the NIST Digital Signature Standard
SKIPJACK		Classified encryption algorithm used by the Capstone system

All information transmitted over public networks between Iowa governmental agencies, the federal government, and private partners should be encrypted. It is not practical to subject the general public wishing to use electronic services from Iowa Government to stringent encryption requirements. The Secure Sockets Layer protocol implemented widely by browsers should be used when exchanging sensitive information such as social security numbers, credit card numbers, health information, etc., with the public.

1.4.4 Performance and Capacity Planning

Capacity and performance planning are related disciplines that help ensure that a given system is designed to adequately support a given computing load.

In an Internet/Electronic Commerce environment, this involves the balancing and optimization of system resources (memory, disk, processor and network) across the general-purpose and dedicated servers that comprise the network site. Considerations include:

- Memory – amount available (more is better); size and location of the systems' paging virtual storage file
- Processor – type of system processor (design, speed, cache), and number of processors (more is better, up to a point of diminishing returns)
- Disk Subsystem – type and number of controllers, caching, use of RAID technology, access profile, types of drives (design, head configuration, capacity)
- Network Subsystem – network adapter types and numbers, number of users, routers, bridges, hubs and other physical components, protocols in use, applications in use, additional services in use

The components are depicted in Figure 5 below.

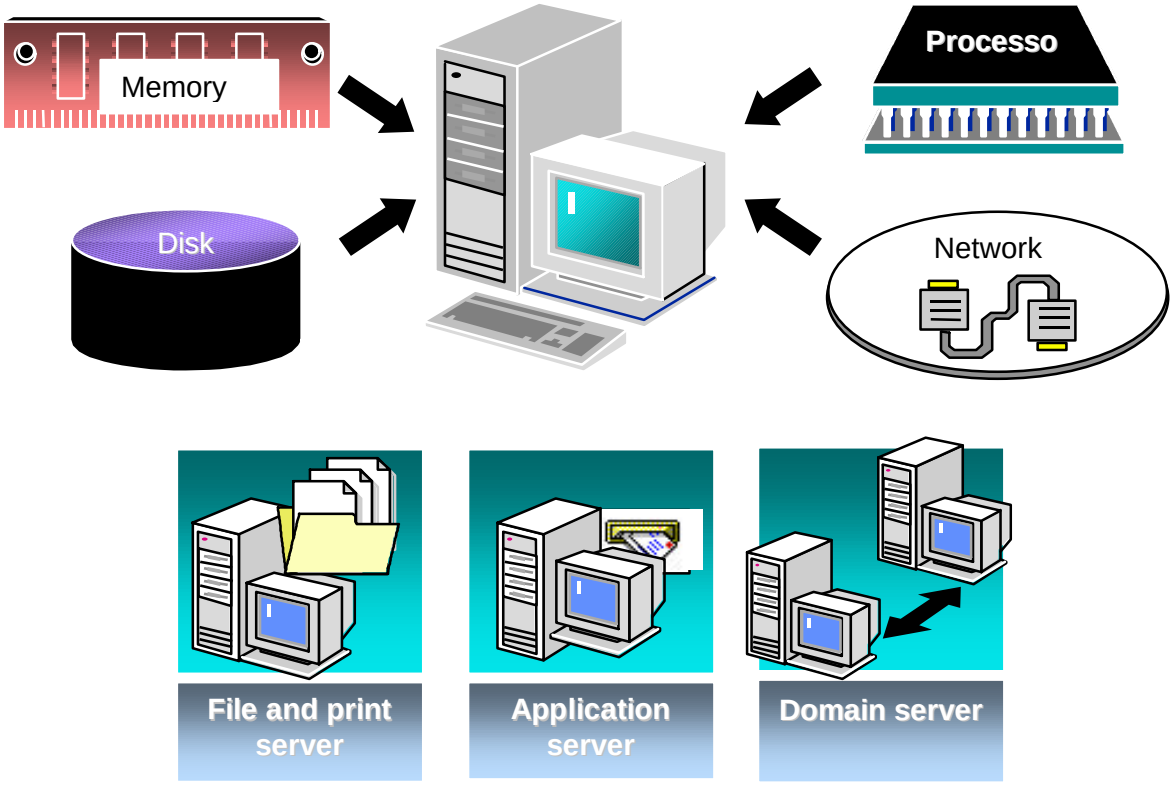


Figure 5 – Performance and Capacity Management Components

The following suggested process will help analyze capacity and performance requirements and aid in their optimization:

1. Create a measurement baseline or reference
2. Establish a database/benchmark of measurement information
3. Determine workload characterization
4. Manage expectations of system usage, availability and responsiveness
5. Forecast future resource allocation and projected growth
6. Establish and implement a plan for long-term tracking and trend analysis
7. Analyze each component for sizing considerations

These processes are described further, with key considerations for each component, in the next few paragraphs.

Create a Baseline

This process involves defining a reference environment:

- Defining a baseline environment, which includes a configured, testbed-scale environment that models the known target production environment. The environment specification will include:
  - Documented server hardware and systems software configuration
  - Applications installed on clients and servers
  - A scaled back network is configured, simulating real-world transfer rates and utilization
  - A defined number of client/user workstations
- Defining a baseline load, which involves configurations of the application software and database. The load specification will also include:
  - Applications loaded and active
  - A defined number of active, logged-in users
  - A reference set of systems transactions (test scripts)
  - Any concurrent batch application and/or system processing

Establish Benchmarks

Establishing a benchmark includes the following process:

- Defining what to measure – Defining specific measurements that will be taken. For each machine, relevant utilization measures of memory, CPU/processor, disk subsystem and network subsystem. For the network, utilization and information flow rates. For servers, additional measures are often taken, including the # of active processes, use of communication channels or sockets, flow rates through the network interfaces, etc. These measures might be expanded later to accommodate additional requirements, and should be reviewed for a given operating system.
- Defining how (and where) to measure – For each of the measures, define a process of creating the baseline load and measuring them. This includes a) an approach for creating the baseline load (e.g., multiple data-entry personnel, script-driven record/playback tools, load simulation tools, network noise generators) and b) the tools for displaying and recording the various measures. Examples of these include both proprietary/OEM products from Microsoft (Systems Management Server) and HP (OpenView, Glance, OpCenter), as well as third-party products from Computer Associates (CA-UniCenter), BMC (Patrol) and IBM (Tivoli/TME).
- Defining baseline measurements for reference environment – Execute the test load in the reference environment, and measure and record the appropriate performance and resource consumption data.

The benchmark provides specific data about the architecture and its behavior under load. This data is used as input into a predictive model used to characterize and predict system behavior.

Determine Workload Characterization

Review and refine the workload model to establish correlations between load and resources. This includes the following steps:

- **Establish Workload Simulation --** Review and refine the benchmark environment until it is in a reasonable state of repeatability and statistical validity. Execute the benchmark across multiple scenarios – normal processing, daily peak, night batch, weekly peak, month-end close, etc.
- **Review load variability patterns --** Document how the load varies across the various processing scenarios.
- **Document resource and performance characteristics --** Review the performance and utilization data across the various load scenarios, and analyze and document the dependencies between the two.

The resulting model allows some ability to predict a system's performance and resource requirements for a given processing load. Note that there are non-linear effects, and extreme extrapolation has to be validated with actual testing, particularly those that involve concurrent processing. For example: If 2 processors yield x-level performance, 20 processors will yield 20x-level performance. If 100 concurrent processes (load) results in a batch window of 5 hours, 1000 concurrent processes will probably require more than 50 hours to process.

Define Requirements

Document the acceptable minimum, and typical expectations of, performance as perceived by various systems users. Considerations to be addressed include:

- **Availability --** The hours and days of operation that the system is expected to be available, usually expressed as a function of hours/day x days/week x days/years (e.g., 24 x 7 x 365 represents full availability, 24 x 6 allows for 1 day a week of operations/maintenance activity). Consider the effect of multiple timezones when dealing with national or global business partners.
- **Usage --** What applications will be in use during what periods, and the users associated with these applications. For example, transactional systems might have limited availability relative to query/information systems. Consider any information on peak processing loads, as these occur on a time-based or event-driven basis.

- **Performance --** Usually expressed in terms of online response (time waits for startup, screen refreshes, response to key-press) and batch response (turnaround on long-running jobs, length of batch window). Often tied to specific system threshold levels (e.g., CPU utilization below 30%). May also include metrics on applications and helpdesk support (e.g., callback within xx hours).
- **Capacity --** Related to performance, the ability to support a given number of users, performing a given set of activities. Users include other internal or external systems that have to interact or interface with the architecture.

Forecast Future Needs

Review current processing requirements, and analyze growth projections to create a future-state processing model. This will include number of users, process complexity (number, frequency and complexity of transactions), increased trading partners, etc.

Establish Monitoring/Review Process

Establish a pro-active review process where the systems architecture is monitored for performance, capacity and growth. A few additional considerations include:

- Watch for peaks – Processing requirements can hit peak levels on both a time-schedule (e.g., month-end close) and event-driven basis (e.g., tax deadline, new legislation).
- Invest in tools and process – Tools and processes to proactively manage systems architectures reflect additional capital and operational expenditures. These should be considered when formulating IT budgets.
- Consider shared systems management infrastructure. Several applications that share the architecture can leverage a common set of architecture management tools and processes.

Component Sizing Analysis

Based on the known current state loads and the projected future loads, and the predictive model, several representative systems architectures can be configured over time. For example, start with 3 dual-processor machines today, adding an additional server to the cluster every 2 years, etc.

A few additional considerations include:

- Consider pooled excess capacity – several applications can share excess capacity if processing schedules permit. These would include additional processors, memory, or disk farms. The economies of scale can be significant, as evidenced by the success of DP consolidator/outsourcers like EDS and Lockheed-Martin.

- Consider the "now vs. later" nature of performance and capacity upgrades. Doing them now involves additional expenditure, but may result in increased system longevity and availability over time. Doing them later results in reduced front-end outlay, and leverages future price/performance improvements, but shortens life of the current system and reduces availability downstream. Each component will have to be examined for the tradeoffs. Some examples include:
    - Network cabling -- The largest expenditure in a cable plant upgrade is often the labor component involved in pulling and installing cable. The guideline is to "get the best you can afford" even if this represents a bit extraneous capacity – for example, if replacing cabling, install CAT-5 wiring even if CAT-3 is adequate; the cost to later upgrade to CAT-5 will be significant.
    - Hardware processors -- Price-performance ratios on PC and server processors have increased dramatically over time. The guideline is to size to capacity, with some allowance for overflow, but configure for expandability. The operating system should be capable of deploying faster, multiple processor configurations.
    - Memory and disk -- Memory and disk prices tend to decrease over time, as technology improvements allow these to be manufactured at higher quality and capacity/performance and reduced unit cost. The guideline is to size to capacity, with some allowance for overflow, but configure for expandability, ideally in a "hot swap" capable manner.

Sizing Guidelines for Internet Servers

Sizing considerations for typical Internet servers are outlined below. Dedicated servers have different load profiles, and the considerations that drive their performance and capacity reflect this.

File/Print Servers – Primary considerations are memory and processor resource contention. Disk and network contention might also constrain performance.

Considerations	Recommendations
Number of users the server can support	• Hardware and software dependent
Users access server to retrieve and update data files	• Consider higher-performance / capacity disk and network subsystems
Users access server for data files and to load applications	• Review server memory

Application Servers – Processor and memory contention are the primary factors that affect performance. To a lesser extent, disk and networks also affect performance.

Considerations	***Recommendations***
Applications are disk/IO intensive and disk subsystems are the bottleneck	• For reads, implement hardware RAID or controller caching • For writes, implement hardware RAID
Applications are memory intensive and memory is the bottleneck	• Increase memory • Reallocate/offload applications or services to other servers
Applications are memory intensive and the network is the bottleneck	• Upgrade the network components • Add additional network adapter cards • Subnet the network
Application is multithreaded or there are multiple applications (e.g., database or mail server)	• Add multiple processors
Application is single-threaded or there is a single application (e.g., 16-bit Windows application)	• Upgrade the processor

Domain Servers – Memory and Network resources tend to be the primary factors that affect performance. Processor contention and to a lesser extent disk contention also have some impact. The primary determinant is the number of user nodes. Note: the recommendations are based on Windows NT 4.x server software.

Considerations	***Recommendations***
CPU Type	• 486DX adequate to 1000 users • Pentium, RISC for larger environments
Systems Administration Memory space	• Allocate 1 MB SAM per 1000 users in 5 MB increments
Memory	• Allocate 16 MB per 5000 users
Pagefile	• Allocate 32 MB per 5000 users
Registry Size Limit	• Defaults okay up to 15000 users; 20-25 MB for each additional 10000 users
Paged Pool Size	• Defaults okay up to 15000 users; 25-30 MB for each additional 10000 users

Sample Guideline: Self-Serve Government Project

This project is implementing a city-wide government access infrastructure to extend government services to multiple constituencies (see Figure 6 below). Access channels include workstations, public kiosks, and touch-tone phone. Hardware and systems software recommendations are outlined below for illustrative purposes only.

Server	• Intel Pentium servers • Microsoft Windows NT server, IIS • Netscape Application Server (KIVA) • ESRI Map Objects (GIS map server)
Clients	• Intel Pentium workstations • Microsoft Windows NT 4.0 Workstation or Windows 95/98 • Microsoft or Netscape web browsers
Kiosk	• Kiosk hardware and software by North Communications • Audio and video multimedia files • POS (Point-of-sale) devices – card swipe, cash depository, etc

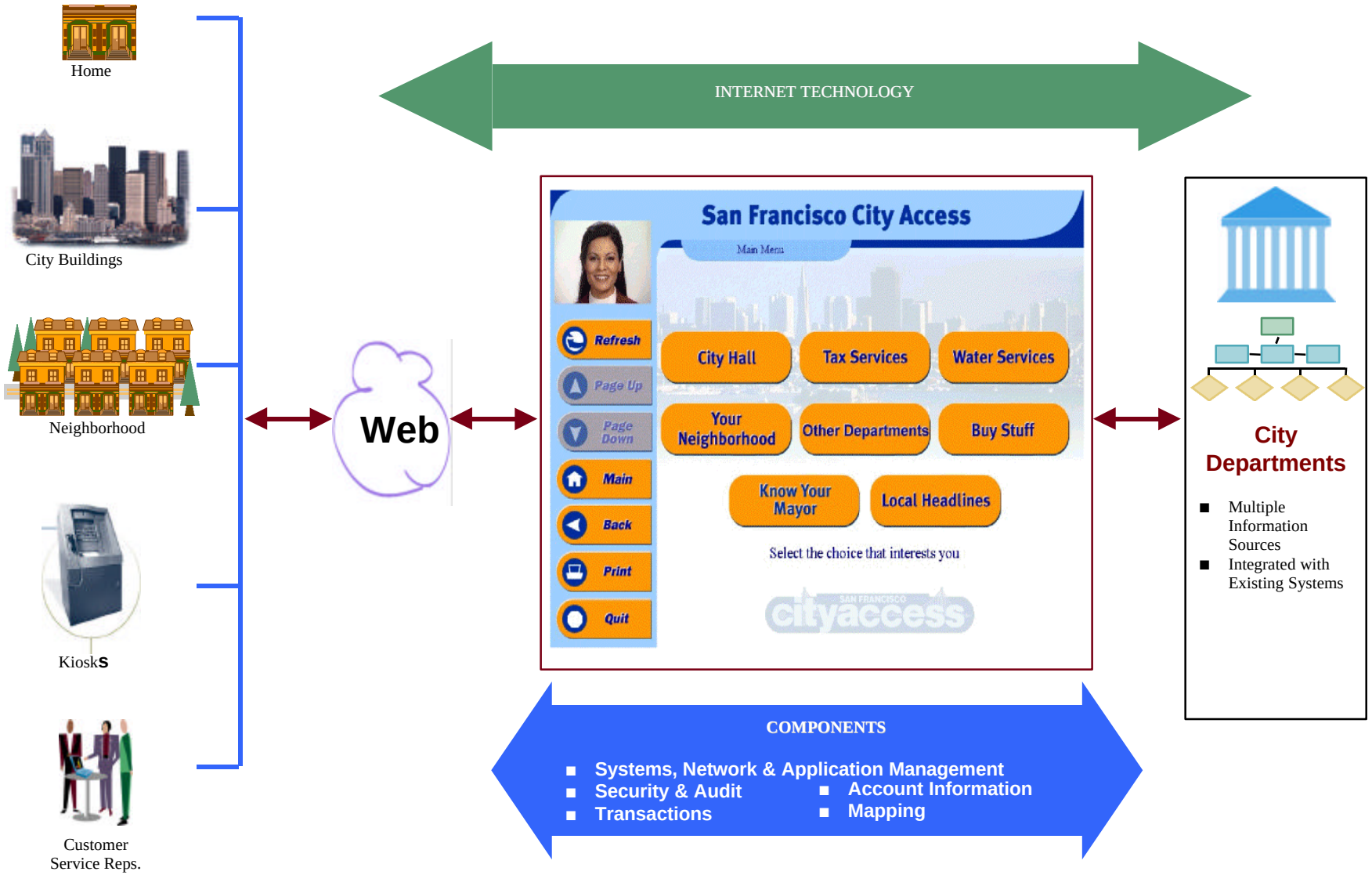


Figure 6 – Self-Serve Government Project

Sample Guideline: Government Internet

This Internet site will comprise a collection of hardware and software that will provide a platform for housing content, applications and communications services belonging to the collective set of networked agencies. The network site will deliver the following services and content:

- Dynamic web-to-database applications, including core data retrieval from multiple agencies
- Indexed search of HTML pages and references libraries on the site hub and agency servers, as well as search of Internet resources
- State web-page content such as news, policies and procedures
- Secure e-mail across agency boundaries

Group collaboration environments (discussion groups)

- Directory services, which supply information about users and provide a foundation for other services that depend on identity, such as e-mail or security. Future applications that could leverage X.500 directory services include:
  - "White Pages" service for personnel-specific information such as telephone numbers, mailing addresses and office locations
  - "Blue Pages" service providing subject-matter listings of organizational programs and activities
  - "Yellow Pages" service presenting detailed information about products and services (e.g., to facilitate procurement activities)
  - "Green Pages" service for querying and browsing information in documents and catalogs, such as publications, statistics, photographs and multimedia records
  - Future Electronic Commerce applications such as Procurement or EDI

The planned architecture for this system is supplied for illustrative purposes only.

Server OS	• UNIX • Microsoft Windows NT
Database Servers	• Oracle (UNIX and Windows NT) • Microsoft SQL Server (Windows NT)
Networks	• Ethernet over CAT-5 wiring • 100M/Gigabit Ethernet or ATM as required • Support Ethernet, TR and ATM switches and routers • IP primary protocol; support for multi-protocol WAN for legacy systems
Web Servers	• Microsoft Internet Information Server (Windows NT) • Netscape Enterprise Server (UNIX and Windows NT)
Search Engines	• Verity Search ’97 (UNIX and Windows NT) • Excalibur RetrievalWare • Microsoft Index Server (Windows NT)
E-mail Servers	• Netscape Messaging Server (UNIX and Windows NT) • Microsoft Exchange (Windows NT)
News Server	• Netscape Collabra (NNTP) Server

1.5 Plan For Action – Organization and Operations

This Electronic Commerce Business Plan is a hybrid document. It takes into consideration the number and variety of organizations which might be covered under its umbrella. The basis of its authority is mostly covered in self-compliance, where the benefits of participating outweigh the costs.

In order to get such a large activity moving, it is often necessary for steps to develop concurrently which ordinarily would go in a different order. To accommodate such needs, this plan offers both strategic and tactical initiatives and recommendations, which are based upon the likelihood of producing acceptable results. It is not possible to make specific recommendations otherwise, without the further investigation of underlying facts. The users of this plan should proceed with this caution in mind.

Tactical issues are addressed in overview, specific recommendations are offered in the EC Opportunity Guidebook, Section 2 of this document.

To carry out the mission of Project 10, we propose that the following recommendations be adapted and put into action. The recommendations are structured as follows:

- Plan Ownership
- Operating Structure
- Plan Maintenance
- Group Purpose
- Operational Sub-Groups
- Workgroup Activities
- Staffing Considerations
- Tactical Projects
- Miscellaneous and General

Plan Ownership

True ownership of the plan belongs to the State of Iowa, and ultimately the citizens. For practical reasons, we recommend ownership be shared between the administrator nominee (ITS) and a representative body of users, called the User Advisory Board. This group will be discussed under the operating structure.

For simplicity, the term owner has been applied to the function of administrator.

Recommendation - this administrative function be vested in the Office of Information Technology Services for the State of Iowa. This group should be well positioned to provide the leadership and facilitation functions needed when leading a group of diverse organizations through technical discussions.

Operating Structure

In view of the nature of electronic commerce development in the marketplace, the best way to operate such a plan is within the structure of a representative democracy.

Recommendation - for the purpose of execution of this plan, **the periodic ownership of the plan is shared between ITS and a user group.** This user group should be made up of a cross-section of interests, such as the IOWACCESS Project 10 group. Representatives of state agencies should cover executive, legislative and judicial branches of government. Urban and rural counties and municipalities should participate. In keeping with the customer driven aspects of this plan, entities outside of Iowa government should be sought out for participation. This might include the federal government or educational institutions as well as private associations of businesses and the general citizenry.

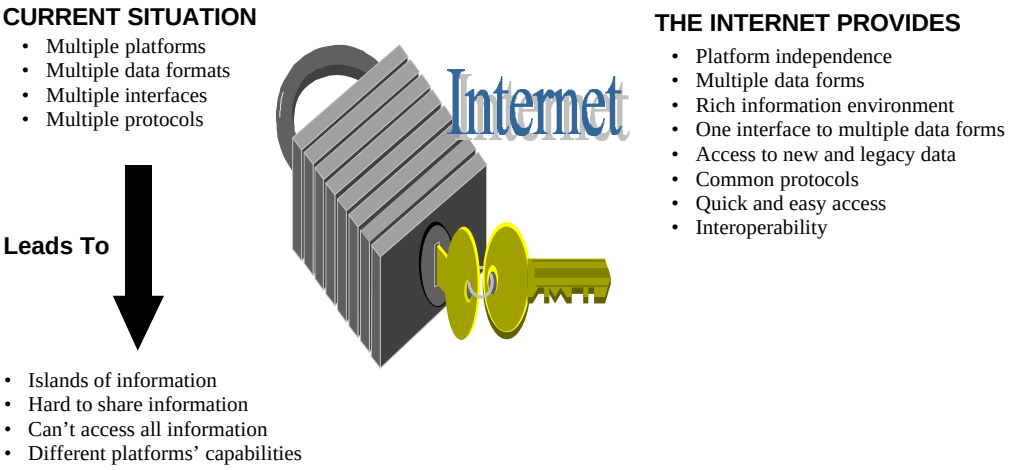
Given the potential size of such a group, interim steps may be necessary. A six month trial period should be undertaken, when proper size can be determined based upon experience. During this time monthly meetings should take place, while at the end of the trial a move to meet every other month or quarterly may be considered. In the facilitation role, ITS should have an agenda distributed to all participants two weeks prior to the meetings.

Plan Maintenance

One purpose of these meetings would be to vote on plan modifications. This includes voting rights, size of group, meeting frequency and other procedural matters. This group would also review the work of the proposed project office. In this capacity, the users would be reviewing EC opportunities brought to light, and use this knowledge to assist in the prioritization of projects. The group would also be able to assist in obtaining funding and other resources based upon knowledge of the issues involved.

Group Purpose

The following picture illustrates some of the difficulties facing participants in this Plan. While the Internet is not the only solution set available, the goals and objectives listed as provided are what this group is trying to obtain.



To accomplish this in the current environment, several tasks may be addressed concurrently. These groups may operate under this or other organizational umbrellas, but it is important that the EC group participates and is aware of the status of such activities.

Operational Sub-Groups

Successful EC applications are built upon a strong foundation. This consists of public policy, legal and privacy issues, and technical standards. On those footings, common business services infrastructure (security & authentication, electronic payment, catalogs,...), messaging and information distribution, multimedia content & publishing and Information Superhighway elements (telecom, cable TV, Internet, wireless,..) provide a firm foundation to support the various EC commerce applications.

It is not advisable to wait for the perfect environment. As long as plans are made with an awareness of possible changes to these elements, business applications can be addressed with reduced risk.

From the survey discussions, the communications infrastructure needs addressing as well as hardware and software needs. The cabling and connectivity needs of participating organizations need review and probable upgrades.

To address likely needs, it is recommended to form sub-groups to address related issues and needs, while developing subject matter experts as a result of this participation.

Recommendation – a Platform & Software Standards group be formed to address the ongoing needs in updating this area. One outcome of this group's work should be a list of minimum needs in the utility infrastructure area, from phone and cable lines, voice and data networks and mail systems, to utility requirements for buildings and offices.

Recommendation – a Communications / Connectivity group be formed to address the needs to link existing and envisioned systems. This group should work with participants to develop requirement lists for standardized systems. The format of this work can then be used by participants in their review of existing systems and future planning to bring operations into compliance.

Recommendation – **Rapid Development Teams** be formed to address major application needs. Organized along the lines of major EC application categories, these teams can work on selected applications to develop reusable solutions in a shortened time frame to achieve success and minimize duplicated/redundant efforts. The number of teams can vary with funding and availability of technical staff, some perhaps on loan from multiple participant groups. Areas to concentrate on would be those indicated as major need areas, which would not be affected by legal issues. Web-site development and publishing would be one area, where applications could proceed if privacy issues were addressed or not applicable. Data warehousing, imaging and document management, and connectivity applications such as e-mail and LAN integration are candidates for workgroup teams.

Workgroup Activities

Recommendation – workgroups should be formed around experience. As soon as a group is formed, the current project list should be reviewed. This list will indicate agencies where projects are underway or completed. Representation from these groups is preferred. Then those who have indicated plans or interests in applications can be invited to participate. Initial meetings will center around experience gained, and identifying obstacles. These would include funding, resource, technical and others. From such discussions, potential candidates for pilot applications of the rapid development team may be gathered.

Staffing Considerations

Recommendation - A **Project Office** should be created to oversee the registration and classification of EC Opportunities within the state. The purpose of this group is to make available to interested parties a listing of current, anticipated or recently completed projects with EC implications. The daily working of this group with projects statewide will create a valuable resource. People with knowledge of these projects will be able to assist users and planners across the state in a number of ways. Technical assistance in how to apply the plan for project evaluation can be offered. Compliance to standards can be checked and tracked by a single source. Potential matches can be made between groups interested in similar or related projects. Users could also be directed to experienced personnel who have accomplished these tasks before.

Recommendation - this office develop an application to automate project information. An interactive web page where EC projects and inquiries could be entered, maintained and searched directly would be helpful to distribute information and knowledge.

Overall, the main purposes of this office or a function similar to it is to foster, encourage and facilitate collaboration and information sharing amongst multiple cross-sector entities in the electronic commerce area. This is enabled by establishing a single source for information regarding EC planning and development. With fiscal and resource constraints as they exist, the leverage of previous experience and concurrent needs is a smart investment in state-wide commerce infrastructure.

A key output of such an office would be a seal of approval or certification that such a project adhered to the standards in place at the current time. Such certification would be useful in funding efforts, and would give assurance to funding agencies with respect to long-term value of the planned solution.

Tactical Projects

Recommendation - the newly created project office go back and contact agencies which have indicated plans to do EC related work in their 1 to 5 year planning. The existing projects should be updated and used **to populate an EC project repository database**. This information will be useful to prioritize initial projects based upon two factors. One is the actual numbers involved/estimated and the other is the number of similar projects where other groups have a common interest. These groups can then be offered an initial introduction and meeting, where the users can assess their ability to work together.

Human Resources

To carry this type of activity to a successful conclusion, new resources must be obtained and developed. The skills and competencies needed for new operations must be mapped against that of existing staff. The difference between these needs and internal availability will drive changes. Training, retraining, new hires and other methods will be required.

When the types of personnel and quantities needed become known, the government must go into the market and bid for these resources. Review of current compensation plans must be made, and adjustments to market situations will be required, if it is possible. Training of current personnel in skill upgrades will only elevate their compensation value to the outside market.

The cross-training of personnel is critical to fill the gaps of key personnel as they move on in this mobile career marketplace. The imposition of standards across the state will reduce the types of specific programming, operating or other skills needed, and will make replacement easier. It will also serve the specific need of personnel to expand their knowledge and skill base. Human resources need to be managed with great care.

Staff retention can be increased by a number of methods. Offering training in skills and systems valued by the private marketplace is a value to career minded people. The challenge and reward of working with a diverse group in creating and implementing best practice solutions and process modifications is also a career carrot.

Recommendation - another possibility is to **expand internship arrangements** with the higher education institutions within the state. People coming through these institutions are more likely to have computer-based skills. Pairing these individuals with state employees having current process knowledge and experience is of benefit to both. Increased computer skills and a fresh way of looking at things may benefit the government employee, as well as give them the pride of mentoring a young talent. The intern gains the usual educational credit benefit, along with an insight into government work and the experience of working on live projects that many private firms would not offer.

Partnering

The current cooperative atmosphere must be extended. The emphasis on partnering with other government and private groups is the key to successful electronic commerce on the scale envisioned. Even more thought must be given to how lines between organizations are drawn.

In some cases, there are private groups carrying out government programs or edicts. Government purchases large amounts from private groups. As private industry shows, the supply chain offers a great opportunity for savings and efficiency. As both supplier and customer become more locked together, and groups both buy and sell to each other with increasing frequency, the idea of a stand alone enterprise becomes harder to conceptualize. Customer and supplier have a stake in each other's success.

With this thought process in mind, earlier legal restrictions should be revisited. Restrictions of public networks and other systems related resources make less sense in today's environment. As public and private entities create and use information supplied to/by each other, the long run may reward those who share required data most efficiently.

Standards

Recommended standards are laid forth in the appropriate section. These standards relate to hardware, software and best practices related to security within the constraints of the legal environment and other factors.

Recommendation - this plan be reviewed every six months for changes to accepted standards, at a minimum. Should legal or other changes become known, the plan should be revised as soon as possible.

Existing systems should be grandfathered in to avoid imposing hardship on users. However, we recommend that six months from adoption of this plan, any new projects or work undertaken be subject to meeting these minimum standards. This includes significant enhancement or modification to existing systems, e.g., enabling web-browser access to existing applications.

Data Privacy/Public Record Survey

Recommendation - all government agencies undertake an internal survey to map the data currently being collected and any envisioned additions. One outcome of this survey is to list not only what data is/will become available, but who may have access to it. As development of web applications become more desired and quickly implemented, control over access to internal data will become a hot topic. Legislative changes may be required concerning what is or is not a public record.

The **danger of not performing such a survey** is the possible liability of distributing private/confidential information to unauthorized parties. Once any information gets out on a public network past the owner (content provider) it is essentially not retrievable.

Such a survey will not impose an undue hardship. Over 75 % of the agencies surveyed had expressly stated interest in Information Management and/or Data Warehouse applications in their response to the Information Technology Business Plan.

Electronic Commerce applications are built upon this foundation. Supply chain management, video on-demand, remote banking, procurement and purchasing, on-line marketing and advertising and others require a solid foundation if the substantial investments are to best realize the intended results.

A good foundation will suffice if its limitations are known and planned around. Digital Signatures/Certificates will be required for a complete EC solution, as one example. However, they need not be in place for other parts of the structure to proceed. As long as future needs/changes are planned for, short-term benefits can be obtained with minimal impact to long term goals. Work on the infrastructure and publishing of timetables for inter-connective capabilities would be the most valuable action to potential users.

General Recommendations

Recommendation - every application slated for implementation on the Internet or Intranet (including current manual or paper-based processes) should be assessed for internal and external interfaces to determine which areas are appropriate for the Internet and which are appropriate for the Intranet.

Recommendation - perform a data analysis to determine candidate legacy or new data sources to integrate with Internet and Intranet sites. This may allow access to important data via browser interfaces.

Recommendation - universal accessibility ensures that Internet sites are developed to serve the largest possible audience using the broadest range of hardware and software platforms, and that the needs of users with disabilities are considered. Systems and tools that help persons with disabilities overcome the barriers to accessibility are constantly being refined and enhanced.

Nevertheless, quite often, new developments are inaccessible to a wide range of web users, either because their hardware and software cannot support the new features, or because the feature was not designed with universal accessibility in mind. Since the end-user cannot count on either standard technology or helping devices to ensure access to information on the web, the web page developer bears the responsibility to deliver the message so that everyone can benefit.

Proposed Activities and Milestones

August 1998 – October 1998

- Approve initial EC business plan
- Form user advisory board
- Create and staff project office
- Create and populate sub-groups
- Identify funding source for efforts going forward

November 1998 – December 1998

- Create EC project repository database
- Select applications and priorities for rapid development teams
- Revise technical standards section from input received
- Publicize EC efforts
- Offer training in EC opportunity recognition and planning for interested parties
- Create standardized data mapping documents to identify information by components and location, and distribute to interested parties
- Provide initial recommendations for any legislation required to support EC activity

January 1999 – June 1999

- New advisory board members selected
- Project successes and savings cataloged
- Status of EC database reviewed for proactive opportunity targeting
- Review future staffing needs relative to experience gained and projects underway
- Recommend staffing and organizational needs, and obtain funding for fiscal year
- Document initial infrastructure needs vision to obtain funding for fiscal year
- Create work group to investigate state-wide data plan to be used as foundation for possible workflow/process realignment
- Select target agencies to assist with existing data integration, based upon legacy systems interfaces, or populating databases with legacy data
- Identify state servers that can be shared for similar applications within security needs and limitations, to reduce operational redundancies
- Create resource to assist participating entities in budget planning and business case justification development

July 1999 – December 1999

- Create report with recommended changes to Iowa government operations and processes based upon input from state-wide data plan
- Revise EC Plan to reflect changes in needed systems planning and funding affected by proposed changes in Iowa government operations
- Create a report explaining new data sharing opportunities based upon successful interfaces with existing data
- Create a state network plan identifying how to navigate and interact with state applications. Encourage increased interaction of other local governments and private enterprise by assisting in planning efforts through knowledge of state data locations.
- Create workgroup to address large scale projects with large cost and payback, such as integrated supply chain management

1.6 Plan For Action – Opportunities

Recommendations are grouped below by the organizations of which action is needed.

Participating Organizations

- Conduct a review of or gather information on the most recent data analysis and surveys. If none is available, perform an analysis. IT strategic plans and budget documents should be reviewed for current situations regarding EC projects and available funding. Then an internal EC opportunity should be undertaken to discover potential projects, following the guidance found in section 2.2 of this document.
- Evaluate potential projects to the degree required in section 2.3 of this document. Use TCO and ROI as a minimum for doing a cost-benefit analysis, using section 2.4 of this document as a reference.
- Follow the guidance of the Project Office processes to obtain further insight into projects which seem viable.
- Participate in the EC Business Plan execution as much as possible. The exchange of ideas and contacts will increase in value to your organization.

EC Project Office and Plan Workgroups

Recommended Projects:

- Institute an online, intranet-enabled EC project tracking system that allows for on-line project requests, provides on-line help to conduct feasibility studies and publishes dynamic information about EC projects in play throughout the state.
- Create an on-line application statewide to allow 24 hour, 7 days per week access to information on back child support to businesses which are required to check when making payments.

- Conduct a review of baseline infrastructure requirements, to assess the current state in Iowa, and develop standards and recommendations:
  - End-User Computing – Standardize on the various elements that comprise an Iowa desktop computing environment. This will facilitate information and data interchange, normalize skill set requirements for both users and operations support personnel, and leverage economies of scale. Elements include PCs, operating systems and desktop productivity suites.
  - Access and Connectivity – Review requirements and standardize on required voice and data connectivity. Benefits are similar to those for end-user computing; in addition they will facilitate systems interoperability. Elements include voice, data, voice and electronic mail, collaboration environments, local and wide area networks.
  - Security – Review the security requirements necessary to enable secure access to Internet applications. These security programs can be leveraged across multiple applications. Areas of focus include authentication (e.g., digital signatures, certificate authority management) and encryption (public/private key management).
  - Integration Functions – Review requirements for function-specific infrastructures that can be leveraged across multiple applications. Areas of focus include electronic funds transfer (EFT – includes payments and deposits) and electronic data interchange (EDI – initial document set could include invoices, requisitions, purchase orders, ship notifications, tax returns, and associated acknowledgements).

The guidelines presented in this report can serve as a reference point; these have to be reviewed in a cross-function, cross-project context to drive out more detailed requirements.

- Web-site development tools need to be standardized. Outsourcing of web-site operations should be reviewed, with the centralized purchasing of such services leading to lower costs. Possible Federal agency services in this area should be reviewed, as well as the development of internal capabilities with new software products to manage such applications as home shopping, purchasing, etc.
- Create a centralized licensing process through which the public can access the wide variety of licensure needs. This should cover professional, businesses, recreational, regulatory, environmental and other licenses. Renewal processes may be automated where security issues are resolved. Such a system would provide many answers with reduced staff interaction. By linking quickly and easily to existing web-pages, the changes in licensing requirements brought about by legislation can be quickly accomplished behind the scene.

- On-Demand education needs to be organized. Remote testing for a variety of licensure and other needs can be facilitated by distribution of test materials with instructions to remote monitors. Community education facilities could give tests and monitor them as needed by potential test takers, without travel arrangements for other personnel. Educational material can be distributed on line, and home study arrangements for a variety of needs can be arranged in a responsive manner.

- Data Warehousing/Information Management was a frequently mentioned project area. A project work team should be organized, and all agencies that indicated interest should be contacted to assess status and invite participation. A project underway or a new project may be selected as a prototype. As this prototype develops, materials derived from it including work plans, status reports and other outputs should be reviewed and organized by the group to form a standardized repeatable application. Additional up-front work or documentation may be added by the group above and beyond what is called for in the project. This is in anticipation of the savings to be gained by following a successful format in future iterations.

- Establish a constituency "self service" application that integrates the various products and services available and presents these in a logically-structured, easy-to-use application. This would be delivered through the web, available via accessible infrastructure, and serves as an umbrella under which the various agencies could offer products and services. It will also feature the appropriate feedback mechanisms, including one-to-one (i.e., electronic mail) and one-to-many (i.e., virtual town hall) communications.

- Create an information publishing and delivery infrastructure wherein constituents (public sector employees and citizenry) can request information on various items. These include new laws and regulations, new guidelines (including access to this plan), and various government forms.

- Review the project opportunities database and initiate the formation of workgroups where shared interest comes forward.

- Provide assistance in identification of EC opportunities and planning. Develop training materials to guide agencies in how to utilize the services and processes of the project office.

- Review opportunities for consolidation of purchasing and procurement activities across agencies, particularly for "indirect" materials and commodity supplies such as office supplies, shop materials and over-the-counter chemicals and pharmaceuticals. These types of applications have been proven as "high gain" EC applications that facilitate benefits along multiple dimensions, which include:

    - Consolidate buying volumes and leverage economies of scale to achieve more competitive markets/pricing

    - Normalize and improve purchasing practices, including process simplification and reduction in purchasing time and cost

- Allow decentralized buying organizations to tailor practices to best meet their requirements, whilst leveraging economies of scale and best practices
- Improved visibility to demand planning and forecasting, allowing suppliers to more intelligently optimize production, resulting in reduced costs and improved availability
- Facilitate the fulfillment and settlement processes through the use of enablers such as EDI and EFT

User Advisory Board and ITS

- Create an organization chart listing temporary personnel on loan from participating groups. Develop a short and mid-term staffing plan to acquire the necessary funding for supporting ongoing efforts in this area.
- Create a Publicity Plan to communicate what is happening, and encourage additional participation as efforts go forward.
- Review the operation of the Project Office every six months, and make adjustments in the scope and mission where needed.

1.7 Plan Maintenance Process

The first step in establishing a growing or "live" plan is to lay the groundwork for its regular update and renewal. Without the input from people affected and concerned, any large scale plan is soon to become "shelfware." Shelfware is very expensive paper that was once useful but becomes a last resort reference if needed.

Participants

Facilitator

Interested parties should update this plan at regular intervals. The official body should be led by a facilitator/moderator. This facilitator takes on the responsibility to be the focal point of input for discussion, and the distributor of agendas, materials and other documents as needed. The facilitator is charged with arranging meeting facilities.

This facilitator should have thorough knowledge of the Plan, and make efforts to keep participation levels high. This might include suggesting participant removal should attendance difficulties make this warranted.

It is our recommendation that a person from ITS be assigned this duty. The succession or substitution process should also be laid out at the time the role is accepted.

Technical Expertise

A party with daily familiarity with EC Projects should provide the technical expertise or the coordination of appropriate parties where needed. This expertise includes adopted standards as expressed in the plan. It also should include current EC projects underway.

This second expertise requirement leads to the recommendation that a member of the proposed EC Project Office be this technical expert. This individual would be aware of where EC projects are on an up-to-date basis in the state. The knowledge gained by working with the projects on a daily basis is the best qualification to update participants on the status of EC activity when discussions require it.

User Advisory Board

The interests of potential users throughout the state require the widest participation feasible across the sub-groups of the Citizens of the State of Iowa. The size of the group should be flexible so as to create a workable body of interested parties.

Parties could be pulled from state, county, municipal and federal government agencies. Educational groups, private associations, business groups and interested citizens may also provide representatives.

For the purpose of getting started, it is recommended that the Project 10 team be nominated for the initial makeup of this board, with their consent. The first meeting should include a decision on expanding the size of the group.

Voting

As the plan is owned by the citizens, the representatives as selected should retain the voting power. Until changed, a single vote per participant is authorized, with simple majority needed for passage.

Voting takes place at regular meetings, which are recommended monthly to start. The adaptation of new standards, regularity, size of the advisory board and timing of meetings and any other issue requires a vote of majority, from at least 2/3 of the active body.

Term

The recommended initial term will be for one year, with early notice to new members of two meetings so they have the chance to preview the group and get up to speed when their official term begins.

Agenda

We recommend board participants receive a meeting agenda and supplementary material at least two weeks prior to meetings. This allows opportunity for preparation, which will enhance the group's efficiency.

Process

Agenda items and proposed standards should be submitted to the facilitator in time for inclusion in the next possible meeting. Proposed motions and/or changes to any other portion of the plan as discussed in the preceding paragraphs should also be submitted at that time.

It is the best use of everyone's time to be fully aware of what will be discussed at a forthcoming meeting.

The vesting of power to modify the plan through vote of the User Advisory Board is believed to be key to the plan's success. This plan is for the benefit of the user community. The best way to obtain plan conformity and user input is to grant participants the power to affect their working environment.

2.0 Section 2 – EC Opportunity Identification and Evaluation

2.1 Introduction

Section 2 describes a process for managers working with EC application opportunities.

Section 2.2 discusses the identification of EC opportunities in a business unit. Where to find such opportunities is suggested. What such opportunities might look like is covered. Then how to proceed when such application opportunities are uncovered. The discussion addresses funding, timing and process issues related to potential projects.

Section 2.3 presents methods of evaluating potential project opportunities. These evaluations can range from simple to complex, depending on the circumstances within the business entity.

Section 2.4 is concerned with the prioritization of projects. How to consider applications vying for the same resources is covered, and recommended guidelines are presented for a level of criteria in selecting between such opportunities.

Section 2.5 contains a Process for the Registration of EC Opportunities with the Project Office group recommended in Section 1. How the users proceed along this process is covered.

By review of this section, people responsible for business and technical planning will have a basic understanding of the EC application, development and implementation process. How to find these opportunities, how to evaluate and present viable projects to achieve desired results should be clear.

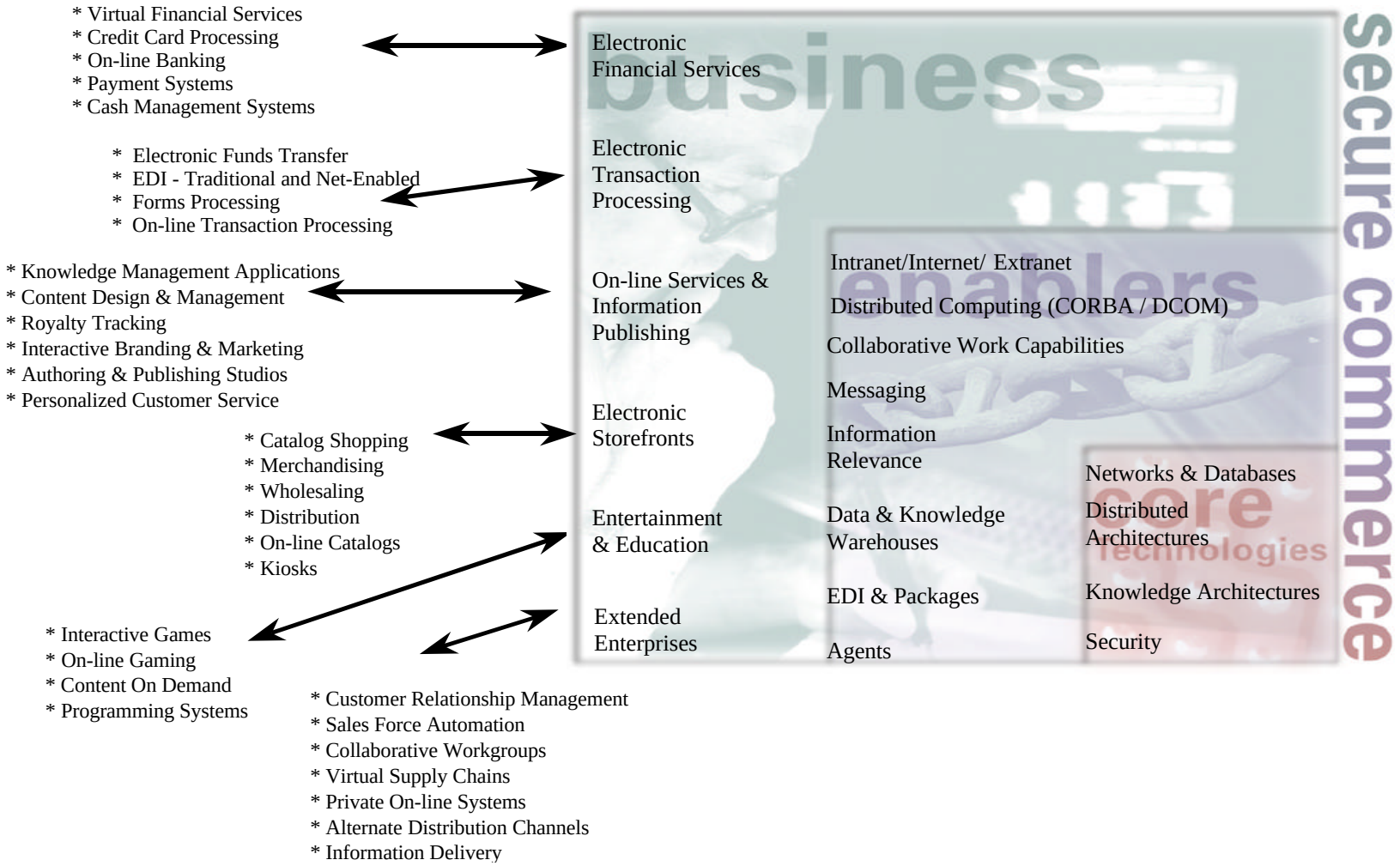
2.2 EC Opportunity Identification

Electronic Commerce is used in many different contexts, with an even greater number of definitions.

The purpose of this discussion will be to identify some basic applications. As a brief overview, it cannot cover all of EC in depth. Users will gain experience over time, and can move on from the basics as they become comfortable with the developing state of EC applications.

The next page presents a view of Electronic Commerce, consistent with the categorization of core technologies, enabling applications and electronic business applications. It offers a summary of some prominent applications and where they fit within the EC world.

Electronic Commerce



2.2.1 Where To Find EC Opportunities

Electronic Commerce applications cover the entire business process. As with many major projects, a new application is often viewed or considered when either the business environment changes require EC-related action, or a business process develops problems.

Where long-term EC projects entail complete business process reengineering for best results, significant short-term gains may be obtained through connectivity and automation of some features.

To find such short-term projects, the best place to look is the point of customer or application systems interaction. At the point of contact, does your representative have access to the information needed to meet customer needs and expectations? If not, what is preventing this? Customers can be internal or external.

Another place to look for application opportunities is in customer complaints. If a pattern is developing, complaints need to be screened for direction. Often complaints result from this same interaction, where representatives were not able to access and deliver information to the customer in the time frame required or expected.

Application opportunities also come to light when negotiating with customers and vendors. Opportunities to save money are often found in repackaging transactions in different volumes. To do this, current methods of information exchange and transfer can be viewed with an eye towards possible changes in transmission or delivery.

Systems interfaces are another source of potential opportunities. Any information that is passed from either between applications or hardware platforms has the potential to offer efficiency gains.

2.2.2 What EC Opportunities May Look Like

The preceding section briefly pointed to where EC solutions might be found. To explain in more detail, an opportunity might be easier to recognize by the function it addresses.

When any person affected by a transaction has real or perceived difficulty in executing a function, an opportunity may be present. A person might be an employee, customer, vendor or interested third party. Examples would include the inability to locate desired information or obtain appropriate access within a desired timeframe.

Regardless of the specific person's identity, when they have a question or need, and the information or service has impediments to obtaining a solution, an EC opportunity may be present.

If a customer asks about a product to be delivered, does the agency know where that product is? If it is under the control of a supplier, is information about it accessible without the need to interface with another party? This chain of events is one of the most visible signs of opportunity. Person A calls Person B to find an order status. Person B, if reachable, tells Person A they will call them back. Person B now attempts to contact Person C. If reachable, and Person C has the desired information, Person B now must re-contact Person A to relate the information obtained. This event chain can get more expanded and confused, with the introduction of fax, voice mail and other methods.

From a simplistic opportunity standpoint, if Person B was granted direct access to Person C's information, the contact between B and C is eliminated. In addition, potential delays and misunderstandings go away. One step further, what if Person A had direct access to Person C's information, even if they had to go through Person B's process. Through customer self-service, the provision of information throughout an organization allows them to refocus resources on exception transactions, away from the routine that often bogs down daily operations.

2.2.3 What Is Done With an Identified EC Opportunity

2.2.3.1 Funding

Most organizations have funds budgeted for systems work. Such funding may be specifically allocated between development and maintenance work.

A first step is to have a working knowledge of available budgeted systems funds, and the status of them within your organization.

Needed funding should be identified, with quick estimates to guide the investigation. If the current funding level will not support such an opportunity, then alternates must be explored. Funding can be requested for future time periods. Funding might be built into new service provision contracts. If customers can be shown the value and savings of systematic improvements, cost savings might be arranged through future service contracts. If vendors can be offered value such as locking in favorable terms in future business, funding and development assistance might be arranged through them.

If similar opportunities can be identified with other entities, such as the participant groups covered by this Plan's process opportunity registration central office, then co-funding with other agencies may be possible.

2.2.3.2 Timing

Timing is always critical. An early review for potential EC projects allows time for the various steps to be completed. As internal opportunities are identified, options open up. A quick prioritization internally is in order. A basic business justification should point towards the economic decision to proceed.

At this point, contact with the recommended Central EC Project Office can provide information on other proposed, active or completed similar projects. The central office can provide contacts with experience that can be leveraged for knowledge transfer and other savings.

This information can affect the initial internal prioritization list. Where projects are planned or underway, the potential to share costs or reuse existing planning, tools and solutions affects initial decisions. The need for internal funds may be reduced by co-development opportunities. The need for a change in potential timing to join such a project may affect internal resource allocation or funding. Information based on successful project completion may provide more accurate cost assessments.

This planned timing must then be adjusted by internal budgeting processes. Needed funds for project elements such as staff, hardware, investigation and other items can then be coordinated with other needs of the organization.

2.2.3.3 Process

The previous section touched upon some of the processes affecting EC opportunities.

The organization's internal budgeting process affects the ability to obtain funding within operational time frames. The potential to include development within the service contract process of an organization can take this out of this normal budget cycle and make it a cost of doing specific business.

The recommended EC Opportunity Registration Process plays an important role in the above processes. Early contact can save valuable time in researching potential opportunities. Outside verification of costs, results obtained and pitfalls experienced can greatly improve the information offered in the business justification of an opportunity.

While co-development may seem to take longer, the critical mass and end results achieved often bring projects to a successful conclusion due to the amount of visibility created. It also provides incentive to follow project management practices that may not be present in smaller projects.

No one process can cover such a consortium of participants. But the issues raised here are applicable in many cases, and should be adapted to fit your specific situation and processes in effect.

2.3 Project Evaluation

Feasibility Analysis

Please note: None of the methods described below will effectively identify all financial components of an EC opportunity when used independently. The methods prescribed below should be used in conjunction with one another to clearly encompass all mission-critical obligations and objectives. Remember that financial planning tools can only script the expected result of a plan, not necessarily the causes. If the financial outlook of a project is less than satisfactory, ensure that the causes are identified and evaluated. Try to eliminate or control adverse factors. Oftentimes, a project analysis that reveals less-than-expected financial returns still satisfies other important factors such as customer service and supporting the overall vision of the State IT Strategy. Analyzing a project's financial picture is just one piece of the puzzle.

In evaluating the feasibility of a potential Electronic Commerce application, it is necessary to determine the application's technical requirements. Technical requirements can be generally classified into five categories: hardware, software, data management, security, and support. The questions that need to be asked include:

- Can the proposed project be implemented with the existing server and network infrastructure?
- How will the data be captured, stored, and distributed?
- What are the requirements from the user's point of view?
- Can the project be implemented following established IowAccess and ITS Standards?

Hardware Requirements

Hardware requirements include server platforms, client platforms, network infrastructure, and data storage subsystems. The goal of identifying the hardware requirements is to determine if the current hardware infrastructure can support the proposed application. In order to determine the hardware requirements for a proposed project, it is necessary to estimate the anticipated number of users. This helps to gauge the amount of network traffic that the application will generate. The number of users and complexity of the application has potential impact on the processor(s), memory, and network interface cards of web servers and firewalls. The amount of data that is to be captured, stored, or distributed must also be calculated in order to determine if additional storage resources will be required. The requirements for client machines must also be addressed. Based upon the intended audience, the minimum configuration required for a machine to access the application or information impacts the potential reach and usability of the application.

A "lowest common denominator" approach should be used in assessing the usability of a potential application - the application should be usable by a majority of the intended audience. It is therefore necessary to ascertain what the lowest configuration in use by the audience is likely to be. If modifications to the existing infrastructure are required such as upgrades to servers, increased bandwidth, or new equipment, the modifications or added equipment should conform to established IowAccess and ITS standards, and the costs need to be determined and factored into the total cost of the project.

Questions for Evaluating Hardware Requirements:

- Does the application require additional or upgraded processing power on web servers, firewalls, or other machines?
- Does the application require additional memory on the web servers, firewalls, or other machines?
- Does the application require additional or upgraded network interface cards on web servers, firewalls, or other machines?
- Does the application require additional equipment such as modems, CSU/DSUs, routers, or hubs?
- Does the application require additional data storage capacity?
- What platforms can the application run on? (PC, Macintosh, Unix, NetworkComputer)

Software Requirements

In evaluating the software requirements it is necessary to determine if the application can be implemented using software development tools that have been adopted as standards. The application should be browser neutral in order to maximize usability. This means that the application should be designed to accommodate at least 95% of the anticipated browser audience; i.e. - MS-Explorer, Netscape Navigator, etc. Platform independence should also be a major consideration, and the complexity of the application should be carefully evaluated. If the application requires frames or third-party plug-ins or custom applets, the usability and accessibility of the application could be severely limited. A lowest common denominator approach similar to evaluating the user hardware requirements should be adopted in evaluating the software requirements as well. Factors including whether the application is heavily graphics-oriented or primarily text-based, impact response time and network load should be considered. The database or software that will be used to capture, distribute, and share information should also be considered in order to ensure interoperability with other systems and applications.

Questions for Evaluating Software Requirements:

- What information will be captured and/or distributed?
- How will the information be integrated with existing systems?
- How can we ensure data consistency and integrity?
- Can the application be developed with existing software development tools?
- On which operating systems and at what revision of OS can the application run?
- On which browsers and at what revision of browser can the application run?
- What database or package will be used to store and/or distribute the data?
- How complex will the application be? (graphics-oriented, text-oriented, multimedia requirements, third party plug-ins, custom applets)?

Data Management Requirements

The possibility for redundant data increases as the number of disparate electronic commerce applications increases. In order to minimize data redundancy and prevent operational inefficiencies from developing, it is crucial to consider how the information from the potential application will be managed. If the information is already being captured and stored elsewhere, the data is not only redundant but data integrity problems arise. The type of information that will be captured or distributed must also be considered. If the information is of a sensitive nature, then it must be encrypted when transmitted across public access networks, and users must be authenticated when accessing the information.

The following questions should be considered in evaluating a potential electronic commerce application since they impact hardware requirements, software requirements, and security requirements.

- How will the data be captured?
- How will the data be stored?
- How will the data be shared and integrated with existing systems?
- How/what are the processes to maintain the data going forward?

Training and Support Requirements

The ability to effectively manage and support the application is critical to its success. The expense and timing of bringing correct skill sets to a project must be considered. The right roles and responsibilities must be defined and the right skill mix must exist in order to make the application feasible. If evaluation of the training and support requirements indicates that application development or support should be outsourced, or that user training is required, the costs associated with these options should be factored into the total cost of the project.

Questions for Evaluating Training and Support Requirements:

- Does the support staff currently have the skill sets to manage and support the application?
- What additional training is required to effectively manage and support the application?
- Does the right organizational structure exist to manage and support the application?
- Does the user require any special training to use the applications?

Cost, Benefit and Risk Analysis

Measuring costs, benefits and risk of an application can be a challenge. Tangible costs, i.e. - those usually budgeted, are easy to identify and quantify. However, intangible costs such as time for learning curves and system downtime are much harder to quantify and evaluate. There are several financial methods used to measure and weigh the costs, benefits and risks of IT EC projects. The methods exposed further are:

- TCO – Total Cost of Ownership
- ROI – Return on Investment
- EVA – Economic Value Added
- Evaluation of Risk

At a very minimum, ROI and TCO should be calculated and evaluated against project objectives. These two methods provide a quick and comprehensive view of a project's financial picture.

Total Cost of Ownership – TCO

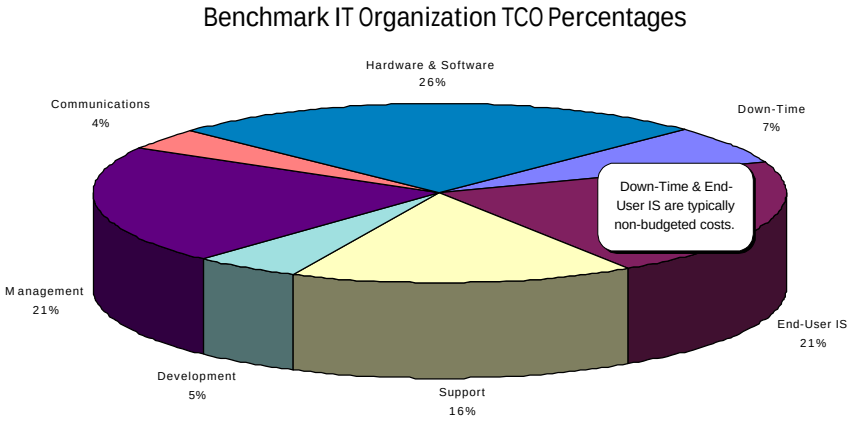
Total Cost of Ownership is an evaluation model that helps identify and quantify budgeted and unbudgeted costs associated with deploying and using an EC-enabled component throughout its lifecycle. Total Cost of Ownership can be divided into two distinct categories: Direct costs and Indirect costs. Using a TCO - modeled approach connects tangible costs of hardware and software with intangible costs such as support, training and downtime.

The TCO Prinicple

TCO has been discussed and utilized by IT shops as early as 1987. TCO modeling helps IT managers and decision makers identify and capture all costs associated with the life of an IT asset. TCO also allows managers to focus in on mission-critical costs, make change recommendations, justify the need for change and monitor costs over the life of an IT asset. The goal of a well-defined TCO model then, is to help IT managers identify every cost associated with the life of an IT asset and help manage or reduce those costs over its lifetime.

Benchmarking TCO Costs

The diagram below represents benchmark TCO percentages for an average IT organization in 1997 as surveyed by Interpose, Inc. Notice the shift in costs from IT support (15%) to End-User IS Support (21%). Traditionally, IT has been burdened with providing most, if not all of end-user support costs. Now, with software applications with better online help and hardware that supports "plug-n-play", IT departments spend less time supporting end-user requests and more time developing new applications. This shift to end-user support has afforded IT shops to build and staff more effective help desk functions, an increasingly important and measurable cost in today's IT department structure.



TCO for desktop PCs range from $5,000 to $13,000 annually with the average being around $6,000. For example, the 1997 average TCO for a DOS/Windows 3.x network client was $6,283 while the average TCO for Windows 95 client was $5,404, according to a 1997 survey by Interpose, Inc.

Taking a closer look at a large organization with 2500 desktop PCs running Windows 3.x, the average TCO per year is estimated to be $7,250. This equates to $18.13 million per year. TCO was calculated at $5,570 per desktop per year if the organization were to migrate towards the Windows 95 platform. That's an estimated potential savings of $1,680 per client or $4.2 million per year (23%).

TCO Components

When collecting costs for a TCO calculation, consider the following list. Keep in mind that if the costs categories below are collected for one TCO analysis, collecting the same information down the road is essential to perform the same TCO analysis for comparative purposes. If it is difficult to capture costs for the initial TCO calculation, take measures to set up accounts and track costs that are material. TCO, as defined candidly by Gartner Group is the new platform for "cost accounting" in an IT shop. Manufacturing has had cost accounting principles for decades. Now with IT being an integral component of nearly every process in a business, IT shops require procedures to capture costs and methods to analyze them. TCO is the tool to accommodate cost analysis and provide project justification in IT departments. Research by Interpose in late 1997 revealed that more than 50 percent of the average organization's growth in IT costs were rarely captured and tracked by IS departments. Therefore, it is as essential to have adequate cost capturing procedures and methods in place as it is to analyze them. The following costs exemplify some of the more common costs associated with IT projects.

Direct Costs (generally budgeted and readily obtainable from IT yearly operating budgets)

- New hardware costs
- Upgrade hardware costs
- New software costs
- Software upgrades
- Network operations costs (excluding communications costs)
- Systems costs
- Depreciation
- Maintenance contracts
- Lease costs
- Materials (tapes, paper, etc)
- Out-sourced systems costs
- Helpdesk setup and maintenance costs
- Helpdesk resolution time
- Training costs (development, out-sourced, etc.)
- Personnel and Staffing
- Application development costs
- Application maintenance costs
- Communication fees
- Travel and overhead
- Employee benefits

Indirect Costs (generally not budgeted)

- End-user costs such as peer support and casual learning
- Asset management
- Staff turnover
- Planned downtime
- Unplanned downtime
- Purchasing costs

One way to justify TCO, especially when TCO breaches the higher end of the accepted cost-per-client spectrum, is to perform a Return on Investment Analysis (ROI). ROI dovetails closely with TCO and together, can provide a sound financial picture of the total costs and expected return of an IT asset. ROI is explored in more detail further on in this document.

Reducing TCO in an Organization

Reducing TCO in an organization requires homework up-front. Hopefully, by going through a TCO/ROI calculation, the collection of costing information for internal services and assets has already been accomplished. This is the start of knowing where to look for TCO cost reduction opportunities. Compare TCO costs with industry averages, note the differences and start from there. While industry averages are aggregate and may not represent your specific line of business, the pie chart above gives percentage relationships that are acceptable in determining representative costs in an IT organization. Industry average costs change as rapidly as technology prices decrease, that being every 4-6 months given the current pace. Current technology costs can be obtained from sources like KPMG Peat Marwick LLP, Gartner Group, or Forrester Research. However, to avoid benchmarking against industry average, the best place to obtain cost of ownership data is from hardware and software manufacturers.

The Software Cost Factor

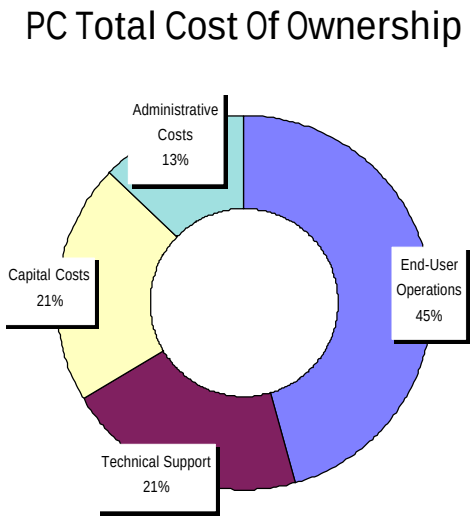
A common way to reduce TCO is by consolidating software upgrades to take advantage of bulk site licensing. The benefits realized are numerous. First, the cost reduction per PC on software upgrades could exceed $100 or more per station. Consolidating software purchases towards planned enterprise-wide upgrades takes advantage of minimizing downtime, minimizing IT installation and support hours and maximizing the cost savings associated with site license purchasing. This can add up to a savings of over $1,000 per desktop per year. When it comes to software and support, look at ways to automate the tasks of managing each desktop. Divergent desktop operating systems and application software platforms significantly increase the cost of support for an enterprise. Standardize on one operating system and one office suite of applications. Microsoft Office and Lotus SmartSuite are two industry leaders well suited for the 32-bit operating system platform.

The Hardware Cost Factor

Managing hardware TCO can be achieved by providing lower priced and more manageable alternatives to traditional PCs. In the near-term, Network PCs lowers TCO by being more manageable and much easier to support over traditional PCs. According to Interpose estimates, TCO could be reduced by nearly 50% by migrating to Net PCs. The primary disadvantage, however, is Net PCs tend to compromise desktop freedom of the user by not allowing custom software installations and one-off or specialty application development privileges. Reviving the concept of distributed-based computing of the past, Windows-based terminals may be an even cheaper alternative to net PCs. A recent analysis by Gartner Group estimates that Windows-based terminals will reduce TCO by an additional 13% per desktop annually.

The Labor Cost Factor

One of the more significant cost components of TCO is the cost of labor. IT labor to support each desktop, help desk labor to answer questions, and even end-user "self-support" time all add significant costs to the TCO lifecycle. The chart below shows the results of an extensive study conducted by The Gartner Group, indicating "End-User Operations" is a key area to address when identifying ways to reduce TCO. End-User Operations is primarily labor used in making office calls, help desk support and providing application training.



Return on Investment – ROI

The Return on Investment (ROI) method is a ratio measurement of the returns of a project to the costs of the project. Returns include the estimated or expected increase in revenues/fees and anticipated cost reductions obtained by undertaking the project. Investments are the costs of the resources needed to bring the project to implementation. ROI is an indicator of effectiveness and efficiency. There are a variety of sophistication levels. Net Income to Total Assets (Costs in this case) is one of the most simple methods to employ. However, sometimes it can be difficult to obtain revenue marks for an IT asset or even larger, an IT department. Therefore, ROI is more readily calculated by evaluating the tangible benefits derived over time by investing in state-of-the-art IT solutions up front. (The section below, "Putting It All Together" showcases an example of calculating ROI over time.)

Economic Value Added – EVA

Traditionally, EVA is cash flow less the cost of capital deployed to generate that cash flow. Cash flow may not necessarily be actual cash generated but expenses reduced and costs deferred. EVA is closely associated with ROI and in most cases the Economic Value Added for a project is equal to the ROI over a set period of time. This is especially true for cost-based departments, like an IT shop, versus a revenue based department.

More often than not, an EC-enabled application will create additional cost-elimination or cost-deferred value and thus, require new ways to tabulate and keep track of its added value to the IT enterprise. In its best scenario, utilizing EVA is as uncomplicated as having employees and managers think like stakeholders. In a revolutionary report published in The McKinsey Quarterly, six principles of a high performance IT department were revealed. All principles point out how and why TCO, ROI and EVA are so closely related. The McKinsey Quarterly article, entitled " Six Principles of High Performance IT" offers some key points in creating value for the IT department or IT project.

1. Segment the user space (including employees, partners and customers) according to the benefit they deliver and receive and how technology affects each.
2. Decide on what this segmentation should look like in the future by comparing to competitors, industries and your department's vision and long-term strategies.
3. Put measurements that are business-based in place. This includes economic impacts, benefits, TCO, etc. You can't improve what you don't measure. Try to evaluate this question for your own project's specific needs: If a business process has been re-engineered to take advantage of electronic commerce or Internet technology, how much value is attributed to the IT investment portion?
4. Set policies and plan for use of IT resources at all levels. Capture that usage as part of the investment costs of new IT or EC systems. Share those investments with those that are benefiting from the expenditures. More often than not, the benefactors do not account for the costs of IT in their own ROI analysis, making their numbers somewhat over-inflated.
5. Put new technology in place first, then develop applications that run on top of the new architecture. Oftentimes, a new project demands new technology and most of a project's budget is eaten by technology upgrades versus adding value from a new application.

Plan for the future when developing your project plan. Plan for expansion outside of your department's boundaries. This is especially true when implementing Internet-based projects.

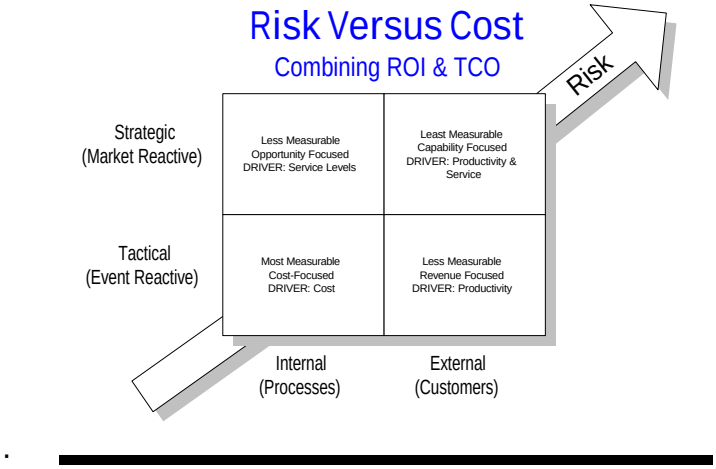
EVA is also referred to as Economic Benefit (EB). EB is part of an ROI analysis, so to complete an ROI analysis, you must have already thought through the several components that comprise EB. Components such as increased productivity and accuracy, gained efficiency in the overall Organization, and potential revenue gains are all considered in EB.

EVA need not be an extensive study to evaluate economic benefits to an organization. Using the simple chart below, an EVA study can quickly be done to augment a thorough TCO/ROI study. The 'Business Benefit' column lists several important factors of an implementation that typically are hard to quantify and measure. The remaining columns provide space to rank importance to the enterprise and capture solution alternatives (A and B). A fourth column could be added to capture known and forecasted risks of each element. Risk evaluation is explored further below. Earlier, it was mentioned that the financial picture of a project may not be justification in itself to move towards implementation. The chart below can help in justifying a project when a complete financial picture isn't available.

Evaluating Project Benefits and Compromises (Economic Impact)

Business Benefit	Importance	Option A	Option B
Functionality			
Performance			
Reliability			
Maintainability			
Scalability			
Flexibility			
Competitive Edge			
Market Leadership			
Time To Market			
End User Satisfaction			
Customer Satisfaction			
Communication/Collaboration			
Productivity			
Cost Avoidance			

Risk Evaluation



Risk Evaluation

Evaluating risk in a project is best achieved by breaking down the components of risk both internally and externally to an organization and then comparing the project's expected outcome to those components. A matrix like the one above highlights that risk is elevated as a project increasingly affects strategic plans and customers. On the low end of the risk spectrum, projects that are event-reactive and meant for internal use represent the least amount of risk. Few departments, systems and no external customers are affected. An example would be a project meant to fix a system processing error or an augmentation to an existing business process. However, a significant amount of risk is exposed when a project is market-reactive and affects a large amount of your customer base. It is best to 'pilot' these types of projects on a small representative subset of your market base prior to full implementation. An example can easily be identified by Amazon.com's entry into the book selling market space. Amazon.com has no retail shop and had no one on the Internet prior to them to model an online sales method after. They pioneered the online sales model and have made it standard by which most online companies study prior to going online. The risk they presented to investors was very high. Like in any risk evaluation model, rewards are commensurately greater with greater risk taken. The struggle managers always face is deciding on what level of risk to take in pioneering new IT products. With the advent of Internet technology, where costs & time-to-market are less, the cost factor plays a less significant role in determining risk, although it still is important. Customer service and satisfaction plays a bigger role in today's risk model. What customer service is increased or compromised? What customers will be alienated or new customers exposed by implementing an EC project? Questions like these are pre-requisites to evaluating risk of an EC opportunity. Adding a column to the chart "Evaluating Project Benefit and Compromises (Economic Impact)" to capture risk is helpful in understanding the global impact of an EC project. A simple snapshot approach to evaluating risk can be captured by using the following chart. The chart contains some of the most common risk elements to an enterprise. There may be more that are evident for your situation and should be included in your version of the evaluation chart.

Evaluating Risk of an EC Opportunity

Risk Level/ Criteria	1 (low)	2	3	4 (high)
Affects departmental strategic direction				
Affects enterprise strategic direction				
Potential increased implementation costs				
Potential increased operational costs				
Potential for added labor costs				
Alienation of primary customer base				
Alienation of tier-two customer base				
Risk of short-term lost revenue				
Risk of long-term lost revenue				

Solution Evaluation Criteria

The rapid pace of advancement in the information technology industry results in new products constantly entering the marketplace. Identifying potential solutions and vendors to assist in developing and implementing an electronic commerce application can reduce the cycle time and cost. Factors to consider in evaluating a potential solution are:

- Product feature set
- Product functionality
- Standards based
- Ease of implementation
- Cost
- Reliability
- Reputation of product

- Reputation of manufacturer
- Stability of manufacturer
- Market share of product
- Market share of manufacturer
- Availability of support
- Availability of training
- References

A Product Evaluation Grid

When evaluating a product or solution, it is key to consider how important a factor is to the entity. For example, a product that transports e-mails from one network to another would be critically dependent upon existing transport protocol standards. In this case, a '5' would be placed in the importance column. Evaluating separate solutions then becomes easy if each criteria is weighed for importance and evaluated for completeness. Multiplying the two columns together derives a 'Total Score' which takes into consideration the importance and the overall evaluation. Adding these scores up reveals the highest overall score to be the best fit choice for the situation. The grid below highlights the major categories to evaluate. Each may be broken down into several sub-categories to help better evaluate a particular situation. For example, breaking down Product Functionality into modules like A/P, A/R, G/L, Security, Administration, User Interfaces, etc., will help identify areas of strengths and weaknesses of the solution.

A Sample Product Evaluation Grid

Criteria	(A) Importance (1 Low - 5 High)	(B) Evaluation (1 Low - 10 High)	Total Score A * B
Product Feature Set			
Product Functionality			
Standards - Based Transaction Sets			
Ease of Implementation			
Cost			
Reliability			
Product Reputation			
Manufacturer Reputation			
Product Market Share			
Manufacturer Market Share			
Support			
Training			
References			
TOTAL >>			

2.4 Prioritization

To evaluate proposed expenditure of resources, Electronic Commerce projects should be judged against other potential project opportunities based upon a number of criteria. Such criteria could include:

- Mandated project:
  - Is this system required to carry out legal obligations or executive orders?
- Funded percentage:
  - Does the project have full funding appropriated, or is additional funding needed?
  - Are the costs to operate the system over time available? (This includes increased personnel costs due to qualifications, etc.)
- Security impact:
  - Have security issues been explored and documented?
  - Does the proposed solution meet minimum-security requirements?
- Quantified payback period:
  - How long will it take to recover the costs involved in creating the solution?
  - How does this period compare with other opportunities available?
  - How accurate can the proposed savings be measured?
- Existing infrastructure:
  - Does this solution utilize existing infrastructure capacity/capabilities?
  - Would this solution impact other applications currently utilizing this infrastructure?
- Committed resources available:
  - Are the needed resources available to do the project?
  - What is the impact or the cost to other projects?

There are many other prioritization criteria that might be used. When the criteria list grows in detail, relative weighting becomes difficult, and ways around criteria are then sought out. This trade off in extensive detail follows the proposition that a 20% effort is expected to provide 80% of the value to be gained.

Checkpoints for Projects:

Does the proposed solution:

- Adhere to the EC Plan and Standards?
- Improve the level of service or expedite a business process?
- Make efficient use of resources required to complete the project?

- Demonstrate future operational cost reductions?
- Make use of existing infrastructure and technology where possible?

Using these guides can quickly provide a basis for developing a business justification case and offer insight as to how a proposed solution stacks up against other opportunities available.

2.5 EC Opportunity Process

For the purpose of this discussion, the assumption is made that the recommended Project Office function has been adopted. All parties required to follow IOWACCESS EC Opportunity Project will do so in a self-policing manner.

It is also assumed that the on-line EC project registration database/web-site project has been completed and is operational.

When an agency or plan participant is going through their planning process, they have access to the online project database. The web-site is accessed, and the potential user browses through completed, current and potential projects. This information can be used to create thinking similar to a group brainstorming session on demand.

When a project is identified, the user gathers as much information as they see fit.

The database is accessed or the coordinator is called to provide basic information on the project. This information is entered into the database, along with requested action from other parties. Information would include:

- Project title
- Quick description
- Sponsoring agency
- Status of project (idea, planned, approved, underway)
- Resource status at sponsoring agency
  - Funded percentage
  - Funding source
  - Hardware needs
  - Software needs (including communications)
  - Skill needs to develop, estimated human resource "man hours" required of skills
- Summary of proposed work

Upon submission, the registering office (Project Office) is ready to undertake the following actions on behalf of the project if requested.

- Provide referrals to previous experiences with similar projects
- Provide referrals to potential developing partners if known
- Provide an assessment of compliance with current technical standards
- Provide assistance with project justification/financial evaluation

As the project goes through various stages, the Project Office coordinator updates the database with status as received from the project sponsor. Depending on the preferences of the sponsor, the database can contain contact information. The information may be displayed online so potential users of similar projects can be contacted directly, or it may be requested that reference contacts may only be given out by the coordinator upon certain conditions. This would allow the coordinator to pass along contact info only to registered proposed projects or some other subgroup.

The database might be expanded to include vendor experiences or performance evaluations, which would be useful in negotiations or selection.

As this process develops over time, the need for direct contact with the Project Office staff should be reduced through automation. The staff should become the trusted advisor or sponsor advocate, with valuable experience related to EC projects and the processes in place at the time. This shared resource will save participating organizations time which will increase as the staff's experience grows.

Appendix I - Acronyms

Acronym	Definition
ACH	Automated Clearinghouse
ADSL	Asymmetric Digital Subscriber Line
ANSI	American National Standards Institute
ASCII	American Standard Code for Information Interchange
ATM	Asynchronous Transfer Mode, Automated Teller Machine, Adobe Type Manager
BASIC	Beginners All Purpose Symbolic Instruction Code
BBS	Bulletin Board Service
BIOS	Basic/Binary Input Output System
BPA	Business Process Automation
BPR	Business Process Re-Engineering
bps	Bits Per Second
BRP	Business Recovery Planning
C/S	Client Server
CAD	Computer Aided Design
CAD/CAM	Computer Aided Design/Computer Aided Manufacturing
CAGR	Compound Annual Growth Rate
CALS	Computer-Aided Acquisitions and Logistics Support
CASE	Computer-Aided Software Engineering
CBT	Computer Based Training
CD- ROM	Compact Disc, Read Only Memory
CDR	Call Detail Recording
CGA	Color Graphics Adapter
CGI	Common Gateway Interface
CICS	Customer Information Control System
CIM	Integrated Manufacturing
CISC	Complex Instruction Set Computer
CMIP	Common Management Information Protocol

Acronym	Definition
CMIS	Common Management Information Standard
CMOS	Complementary Metal-Oxide Semiconductor
CNOS	Corporate Network Operating System
CoBOL	Common Business Oriented Language
COLD	Computer Output Laser Disc
COM	Common Object Model
CORBA	Common Object Request Broker Architecture
CPI	Common Programming Interface, Continuous Process Improvement
cps	Characters Per Second
CRC	Cyclic Redundancy Check
CRP	Capacity Requirements Planning
CSF	Critical Success Factor
CSI	Computer Security Institute
CSU	Control Service Unit
DAL	Dedicated Access Line
DASD	Direct Access Storage Device
DB	Database
DB2	Database 2
DBA	Database Administrator
DBMS	Database Management System
DCE	Distributed Computing Environment
DDE	Dynamic Data Exchange
DDL	Data Definition Language
DIA	Document Interchange Architecture
DISA	Data Interchange Standards Association
DLL	Dynamic Link Library
DM	Data Mining
DMA	Direct Memory Access
DME	Data Management Environment
DML	Data Manipulation Language

Acronym	Definition
DNA	Digital Network Architecture
DNS	Domain Name Service, Domain Name System
DOS	Disk Operating System
Dpi	Dots Per Inch
DPNSS	Digital Private Network Signal System
DPP	Distributed Parallel Processing
DRAM	Dynamic Random Access Memory
DRM	Distributed Resource Management
DRP	Distribution Requirements/Resource Planning
DSS	Decision Support System
DSU	Data Service Unit
DTE	Distributed Transaction Processing
DVD	Digital Video Disk
EBCDIC	Extended Binary-Coded Decimal Interchange Code
EC	Electronic Commerce, European Community
ECC	Error Correcting Code
EDA/SQL	Enterprise Data Access/Structured Query Language
EDI	Electronic Data Interchange
EDIFACT	Electronic Data Interchange For Administration Commerce and Transportation
EDM	Enterprise Distribution Manager
EFT	Electronic Funds Transfer
EIA	Enterprise Information Architecture
EIM	Enterprise Information Management
EIS	Executive Information System
EISA	Extended Industry Standard Architecture
EMS	Expanded Memory Specification
ERP	Enterprise Resource Planning
ESA	Enterprise Systems Architecture
ESD	Electronic Software Distribution

Acronym	Definition
ESDI	Enhanced Small Device Interface
ESS	Electronic Switching System
EUC	End User Computing
FASB	Financial Accounting Standards Board
FCC	Federal Communications Commission
FEP	Front End Processor
FEPI	Front End Programming Interface
FFS	Fee For Service
FIPS	Federal Information Processing Standard
FT	Fault Tolerance
FTE	Full Time Equivalent
FTP	File Transfer Protocol
Gb	Gigabit
GB	Gigabyte
GDS	Global Directory Service
GEIS	GE Information Systems
GIF	Graphical Interchange Format
GIPS	One Billion Instructions Per Second
GIS	Geographic Information System
GPS	Global Positioning System
GUI	Graphical User Interface
HDCD	High Density CD
HTML	Hyper Text Markup Language
HTTP	Hyper Text Transport Protocol
I/O	Input Output
ICR	Intelligent Character Recognition
IDL	Interface Definition Language
IDM	Integrated Document Management
IDNX	Integrated Digital Network Exchange

Acronym	Definition
IE	Information Engineering
IETF	Internet Engineering Task Force
IOS	Internetworking Operating System
IP	Internet Protocol
IPX	Inter-network Packet Exchange
ISAM	Indexed Sequential Access Method
ISDN	Integrated Service Digital Network
ISO	International Standards Organization
ISP	Internet Service Provider
ISPBX	Integrated Service Private Branch Exchange
IT	Information Technology
IWS	Intelligent Workstation
JCL	Job Control Language
JIT	Just In Time
JPEG	Joint Photographic Experts Group
KB	Kilobyte
Kbps	Kilobits Per Second
KBS	Knowledge-Based Systems
KMS	Knowledge Management System
LCD	Liquid Crystal Display
LED	Light Emitting Diode
MAN	Metropolitan Area Network
MAP	Manufacturing Automation Protocol
MAPI	Messaging Application Programming Interface
MB	Megabyte
Mbps	Megabits Per Second
MCA	Microchannel Architecture
MIME	Multipurpose Internet Mail Extensions
MIPS	Millions of Instructions Per Second

Acronym	Definition
MMMC	Minimum Monthly Maintenance Charge
MPEG	Motion Picture Experts Group
MRP	Materials Requirements Planning, Manufacturing Resource Planning
NACHA	National Automated Clearinghouse Association
NCSC	National Computer Security Center
NetBIOS	Network Basic Input/Output System
NOS	Network Operating System
OCR	Optical Character Recognition
ODBC	Open Database Connectivity
ODBMS	Object-oriented Data Base Management System
OEM	Original Equipment Manufacturer
OLE	Object Linking and Embedding
PABX	Private Automated Branch Exchange
PCL	Printer Control Language
PDA	Portable/Personal Digital Assistant
PERT	Program Evaluation and Review Technique
PIM	Personal Information Manager
PLC	Programmable Logic Controller
RIP	Routing Information Protocol
RISC	Reduced Instruction Set Computer
RJE	Remote Job Entry
RMS	Record Management System
ROA	Return On Assets
ROE	Return On Equity
ROI	Return On Investment
ROM	Read Only Memory
SDK	Software Developer's Kit
SFA	Sales Force Automation
SGML	Standard Generalized Markup Language

Acronym	Definition
SIMM	Single Inline Memory Module
SMTP	Simple Mail Transfer Protocol
SNA	Systems Network Architecture
SNMP	Simple Network Management Protocol
SPARC	Scalable Processor Architecture
SPX	Sequenced Packet Exchange
SQL	Structured Query Language
TAPI	Telephony Applications Programming Interface
TCO	Total Cost of Ownership
TCP	Transmission Control Protocol
TCP/IP	TCP/Internet Protocol
TIFF	Tagged Image File Format
TPM	Transactions Per Minute
TPS	Transactions Per Second
TRN	Token Ring Network
TSR	Terminate and Stay Resident
UCC	Uniform Commercial Code
URL	Uniform Resource Locator
VAN	Value Added Network
VAR	Value Added Reseller
VAX	Virtual Address Extension
VLSI	Very Large Scale Integration
VMS	Virtual Memory System
VRAM	Video Random Access Memory
VRML	Virtual Reality Modeling Language
VSAM	Virtual Storage Access Method
WAN	Wide Area Network

Glossary

Term	Definition
American National Standards Institute (ANSI)	An association of volunteer US business partners that set Internet standards.
American Standard Code for Information Interchange (ASCII)	The standard method of representing ordinary text as a stream of binary numbers. It is a code set of 128 characters; the first 32 characters are control codes and the remaining 96 are upper- and lower-case letters, numbers, punctuation marks and special characters.
Anonymous FTP	The process of connecting to a remote computer as an anonymous user to transfer files back to a local computer.
Archie	The program which enables the user to find files on the Internet to transfer to a local computer. Archie searches the Internet and provides a list of all the locations of the type or name of file the user is looking for. “Archie” is derived from the word Archive.
Archive	A backup copy of data. Designed to be kept long term, often for security or audit reasons.
Architecture	A description of a system, set of systems or business operations. A real world structure for implementing technology solutions to support business processes.
Bandwidth	The maximum speed at which data can be transmitted between computers in a network.
Beta Version	An early release of a software package version to a limited number of users to test and identify problems before releasing the software to the market place.
Browser	An application that interprets HTML and displays a web page. Used to view the Internet. Examples include Internet Explorer, Netscape Navigator, and Mosaic.
Bulletin Board System (BBS)	The system that allows subscribers to copy files to a local computer, send messages to other users of the bulletin board, play multi-player games. The Internet has generally superseded BBSs.
Client	A software program that is used to contact and obtain data from a server software program on another computer, sometimes across a distance. Each client program is designed to work with a specific server program, and each server requires a specific kind of client. A web browser is considered a specific kind of client.
Cookie	A piece of information that a web server sends to a web browser that the browser software is expected to save and send back to the server whenever the browser makes additional requests from the server.
CyberCash	A secure method of electronic commerce payment on-line.
Daisy Chain	A number of computers and/or peripherals are connected to each other in a series.
Data	The content of a file.
Database	A collection of data organized and structured for easy location and access.
Device Driver	The software that allows a computer to command hardware devices such as a printer or a mouse.
Dial Up Connection	A temporary connection between two computers via a telephone line, normally using a modem.

Term	Definition
Dialog Box	A box displayed by a program including a message indicating that something is about to happen or has just happened. The dialog box requires the user to respond to the message before continuing with what it is about to do.
Domain Name	The domain name is a unique name that identifies an Internet site. The domain name requested by an Internet user is converted into an IP Address. The location of the machine with this IP address is located and the information being requested is accessed.
Download	To copy files from another computer to a local computer via a network or using a modem.
Electronic Commerce	The combination of technologies, applications, processes and business strategies for conducting secure business, not only buying and selling but also servicing customers and collaborating with business partners.
Electronic Data Interchange (EDI)	The computer-to-computer exchanges of business data in a standard, machine-processable format. The information is generally patterned after a conventional paper document.
Electronic Storefront	The use of technologies to enable businesses to conduct on-line product sales and transactions.
Electronic Mail (E-mail)	The form of electronic messages transmitted over the Internet from user to user. E-mail can contain text, but can also carry with it files of any type as attachments.
Encryption	The process of converting data into unreadable code for security purposes.
Ethernet	A method of networking computers in a LAN. Ethernet will handle approximately 10,000,000 bits-per-second and can be used with almost any type of computer.
Extranet	A private network inside a company or organization that utilizes the same protocols as the public Internet but is for internal use and can be accessed externally exclusively by authorized users.
File Transfer Protocol (FTP)	A standard for moving files from one computer to another. Predominant use on the Internet.
Firewall	A combination of hardware and software that separates a local area network into two or more parts for security purposes.
Gateway	The hardware or software set-up that translates between two dissimilar protocols. Gateway can also be defined as a mechanism for providing access to another system.
Hacker	A user who deliberately logs on to other computers by bypassing the security system. This is done to steal valuable information or to cause irreparable damage.
Hard Disk	The hard disk is where the data is stored within the computer.
Hardware	The physical components of a computer including peripherals.
Hit	A single request from a web browser for a single item from a web server.
Home Page	The main page of a web-site.
HTTP	The protocol for moving hypertext files across the Internet.

Term	Definition
Hypertext	Any text that contains links to other documents. Can be words or phrases that can cause other documents to be retrieved and displayed.
Hypertext Mark-up Language (HTML)	The text based language used to construct web pages. Interpreted by web browsers.
Internet	The vast collection of inter-connected networks that all use TCP/IP protocols. Evolved from ARPANET of the late 1960.
Internet Access Provider (ISP)	An organization that provides access to the Internet.
Intranet	A private network inside a company or organization that utilizes the same protocols as the public Internet but is only for internal use.
Local Area Network (LAN)	A computer network limited to an immediate definable area.
Mailbox	The file or directories where a user's incoming e-mail messages are stored.
Menu	A list of options presented to the user to perform a specific task. Each option on the list will perform a different task.
Multipurpose Internet Mail Extensions (MIME)	The standard for attaching non-text files to standard e-mail messages. Non-text files include graphics, spreadsheets, formatted word-processor documents, sound files, etc.
Multi Media eXtensions MMX	A technology that is featured in microprocessors designed for multi-media applications. The application running must have been written to take advantage of MMX technology.
Modulator, DEModulator. (Modem)	A device that allows a computer to talk to other computers through the phone system.
Network	Two or more computers connected together to share resources.
Post Office Protocol (POP)	An Internet protocol that enables a single user to receive and read e-mail from a mail server.
POTS	The Plain Old Telephone System
Point-to-Point Protocol (PPP)	The most popular protocol that allows a computer to use a standard analog telephone line and a modem to make TCP/IP connections to the Internet.
Search Engine	A database that allows the user to search the World Wide Web for web-sites relating to a particular subject, e-mail addresses, articles posted to a Newsgroup or companies which have a presence on the Internet.
Serial Line Internet Protocol/Point-to-Point Protocol (SLIP/PPP)	The standard that enables a user to connect to the Internet using a modem and a telephone line.
Server	A computer or software package that provides a specific kind or service to client software running on remote computers. Can refer to a specific piece of software or the machine on which the software is running.
Shareware	Software that can be obtained for free. The author of the software does request a small fee to pay for registration, documentation etc.
Simple Mail Transfer Protocol (SMTP)	The main protocol used to send e-mail on the Internet. Consists of a set of rules for how a program sending mail and a program receiving mail should interact.

Term	Definition
Software	A series of instructions that causes a computer to perform specific tasks and functions. There are systems software and applications software.
Spam	An inappropriate use of an e-mail mailing list as an unsolicited broadcast medium by sending the same message to a large number of users who did not request the information.
Spider	A search engine that obtains and stores its information by starting at a specified web-site and visiting each web page that has a link to it from the current page.
Structured Query Language (SQL)	A standard specialized programming language for managing, retrieving, changing and deleting records from relational databases.
Telnet	A program that is part of the TCP/IP protocol. Its purpose is to allow a user to logon to a computer from a remote location.
Transmission Control Protocol/Internet Protocol (TCP/IP)	A standard set of protocols that govern the basic workings of the Internet which was implemented in 1982. TCP ensures that data is transmitted correctly between two computers. If errors occur, they are detected and the data is retransmitted. The data transmitted is split up into small portions called data packets. IP is how data packets are moved from one point to another.
Upload	The process to copy files from a local computer to another computer via a network or using a modem. Opposite of download.
Universal Resource Locator (URL)	The standard to provide the address of any resource on the Internet that is part of the World Wide Web.
Web Browser	An application program which interprets HTML and presents the final web page. Examples include Internet Explorer, Netscape Navigator, and Mosaic.
Web Master	The person who is responsible for looking after a particular web-site.
Web Page	An HTML document which contains information which can be viewed through a web browser.
Web-Site	A group of web pages which have been developed together to present information on a specific subject(s).
Wide Area Network (WAN)	A network that covers a large definable area.
World Wide Web (WWW)	The Internet facility which allows the universe of hypertext servers to be connected together.

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Appendix III - Case Study

Acme Manufacturing, Inc., is evaluating several web enabled Supply Chain Management solutions. The ideal solution should be able to coordinate thousands of vendors' databases including pricing schedules, product availability, product shipping and location information. Since the technology area of web-enabled supply chain management is in its infancy, company stability, product acceptance and market share are key concerns. Several installations of the products being reviewed have been identified in other industries. Permission has been granted to go on-site and ask employees, management and executives a few questions about their installation of the software solution. The following chart has been developed to critically evaluate product richness and company viability with a non-biased approach.

The evaluation model has been segmented into four sections:

Section A - Baseline Business Processes. General questions which require essay type responses.

Section B - Organization. General questions useful in interviewing users and/or companies that have installed the software product.

Section C - Technology. Questions providing a cursory review of the manufacturer's use of technology in the product.

Section D - Product Specific Evaluation. The actual evaluation matrix.

A. Baseline Business Processes

- Immediate concerns
- Long term concerns
- Define the EC strategy
- Purchasing
  - Inventory need generation
  - Requisitioning
  - Purchasing (P/O generation)
  - Fulfillment
  - Delivery
  - Receipt
  - Tracking
  - How are exception buys processed?
  - Who audits or is responsible for auto-buys?
- Accounts payable
- Cash flow management
- Inventory control

- Levels of authority
  - Requisitioning
  - P/O generation
  - Inventory receipt and tracking
  - Payment
- Error conditions
  - What constitutes a flag in the purchasing process?
- Training
- Who does purchasing training? How?
- Who does system training? How?
- Who trains on system management?

B. Organization

User/Pilot Questions

- Overall, do you like the pilot system?
- How involved were you in the design, development, deployment, and modification process?
- What don't you like?
- What do you like?
- Where has the system changed the purchasing process?
- Where has the system degraded the purchasing process?
- Was there adequate training?
- Were the developers and software product people easy to deal with? Were they knowledgeable?
- Does the vendor understand your business process and needs?
- In your mind, does the system require a lot of maintenance, some maintenance or very little maintenance?
- Did you have to re-enter existing data?
- Does the system require entering data more than once? If so, where?
- Is there data not needed that is required to be entered?

C. Technology

- Technology minimum/recommended/maximum
  - Browser/Client
  - Web server
  - Applications server
  - Database server

- Vendor evaluation
  - Accounts management
  - Distribution channels
  - Key markets
  - Domain/Industry expertise
  - Flexibility in licensing
  - International presence
  - Third party alliances
  - Vision, in the industry
  - Vision, product design
  - Financial stability
  - Sales trend
  - Qualified personnel
  - Years in business
  - Satisfied customer base
  - Number of installs to date
  - Demonstrates best in class
  - Vendor supported installation
  - Vendor supported help desk
  - Service contract parameters
  - Use of third party commerce service providers to integrate small supplier's e-catalogs
- Industry Evaluation
  - Product maturity versus industry maturity
  - Industry rank?
  - Product rank?

D. Product Specific Evaluation

- General product capabilities
  - Supports OBI
  - Compatibility with various data base warehouse platforms
  - Daily transaction volume capability
  - Supports user profile management
  - Supports "trading partner" profiles
  - Supports "authorization routing" tables

- Security features
  - PGP support
  - Separate login procedure
  - Selective accessibility
  - User-sensitive menuing
  - Concurrent activity/session control
  - Support for major firewall vendors

- Product TCO evaluation
  - Base license and fees
  - Consulting costs
  - Database engine licenses
  - Hardware
  - Upgrades/buys
  - Workstation upgrades/buys
  - Installation costs
  - Licenses: per seat
  - Licenses: “lite” clients
  - Licenses: additional server installations
  - Maintenance costs
  - Third party add-ons
  - Training costs
- Service and support
  - Are there standard documentation manuals?
  - Will there be customized procedural documentation manuals?
  - On-line help?
  - Multi-language support?
  - Pre-published version release schedules?
  - What are the available support channels?
  - Availability of third-party support?
- System implementation
  - Easily import/map to data from legacy systems
  - Supports multi-currency transactions
  - Supports international vendor relationships
  - Supports user activity and tracking logs
  - Supports data archiving
  - Supports automatic purging

- Web-enabled interface
  - Intuitive design
  - Customizable interface
  - Out-of-box suitability to current business processes
- Robust search engine
  - By product
  - By vendor
  - By parametric data
- Reporting features
  - Financial
    - Cash commitments report
    - Cash requirements report
    - Cash flow impact
    - Cash projections/forecasting
  - Purchasing
    - Activity by supplier
    - Activity by buyer
    - Activity by product
    - Activity by purchase order
    - Activity by department
    - Automated buy activity
    - Purchasing forecasting reports
    - Error/exception reporting
    - Order status tracking
  - Inventory
    - Inventory by supplier
    - Inventory by buyer
    - Inventory by department
    - Stale/slow moving stock report
    - MOQ reporting (minimum order quantity)
    - Inventory levels and forecasting reports

Purchasing Function

- Processing features
  - Seamless catalog presentation
  - On-line approval
  - Automatic authority messaging & routing
  - Supports e-mail notification
  - Ability to change/edit pre-populated fields
  - Handles RTS' (return to stock)
  - Handles RTVs (return to vendor)
  - Supports user-defined templates
  - Supports enterprise-wide templates
  - Supports "save" feature
  - Allows line-item editing of requisition
  - Allows line-item editing of PO
  - Handles taxable/not-taxable orders
  - Handles import/export tariffs
- Multiple vendor on-line catalog support and management
  - Managed by purchaser
  - Managed by vendor/supplier
  - Pricing/rate sheet version management
  - Supports fax and phone-in purchase orders
  - Supports non-integrated vendors
  - Supports functional acknowledgement reconciliation
- Online catalog features
  - Part
  - Description
  - Pricing strategy
  - Availability
  - Parametric data
  - Multi-media
- EDI
  - EDI translation set compatibility
  - Automatic routing of purchase order to selected vendor(s)

- Seamless purchasing
  - Multi-vendor comparing by price and availability
  - Spilt purchase order transacting
  - Split EDI transacting
  - Automatic purchase order generation
  - Supports auto-purging of stale requisitions and purchase orders

Purchase Order Tracking

- By department
- By requisitioner
- Ability for on-line purchase order/payment status inquiry
- Supports purchase order version control
- Supports purchase order amendments

Systems Integration

- Integrated into accounts payable system
- Integrated into inventory management software
- Integrated into asset management system
- Integrated into workflow management software
- Integrated into e-mail service software
- Integrated into fax processors
- Customizable fields for product
- Supports activity/product-based costing

Payment Support

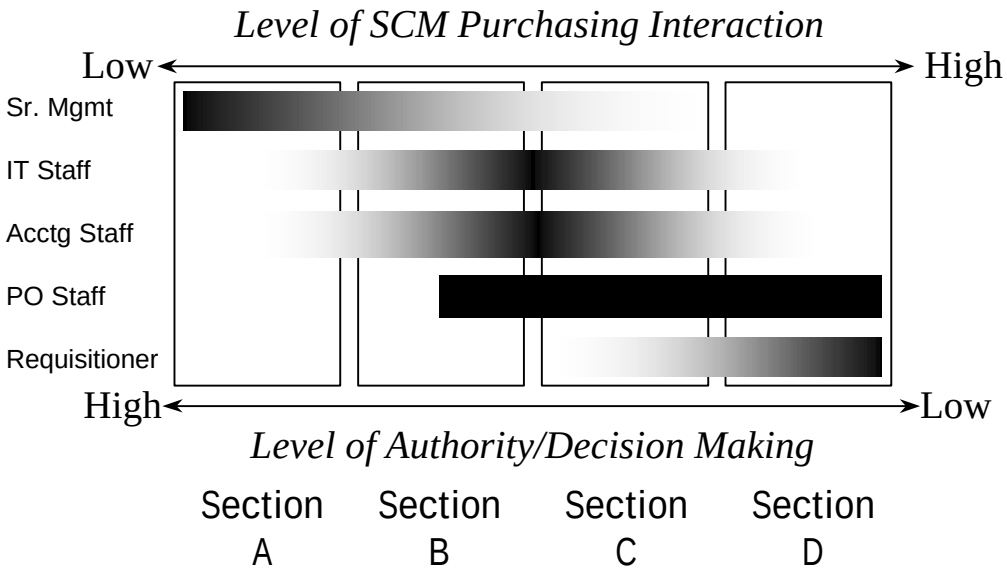
- Procurement cards
- Open purchase order/account
- Multiple remit-bill-to address management
- Ability to connect to external payment networks
- Ability to remit payment from multiple cash sources
- Ability to withhold payment, delay payment
- Printable tracking of payment history
- Allows payment without purchase order

Inventory Receipt Support

- Allows end-user matching
- Multiple ship-to address management
- Unfilled purchase order report generation
- Ties into inventory management module

Ideally, when you design questions to evaluate a software solution, try to encompass the entire audience in which you will survey. Take into account level of authority, responsibility, time and project involvement. This will help focus questions to the right level of responsibility. The scenario above maps something like this:

Mapping The Evaluation Tool To Your Audience



Appendix IV - Putting it All Together: An Example Using Microsoft's Desktop TCO and ROI

Calculator

Combining every component of TCO, ROI, EVA and Risk Analysis is not necessarily required for every project, however, collectively they provide a clear picture of a project's worth to an organization. Let's take a look at an example operating system migration project using the evaluation methods mentioned above. The tool used for this example is Microsoft's Desktop TCO and ROI Calculator. The tool is specifically designed to calculate the TCO, ROI and Economic Benefits of migrating to 32-bit operating system platforms, a common occurrence for today's IT shops migrating towards web-enabling client-server platforms and intranets. While the tool is specific to migration-type projects, the resulting output, an MS-Excel spreadsheet, can be modified to fit an organization's specific project requirements.

The Example Project

Our example project takes an IT department with 200 PCs over 12 sites, all requiring migration from various operating system platforms to a common 32-bit platform. By migrating to a 32-bit operating system environment, it is expected that Internet-enabled applications can be deployed faster and with less effort. Some of the primary assumptions of the example TCO & ROI calculation are:

- 76 PCs are running Windows 3.x (These will be upgraded to 32-bit platforms)
- 100 PCs are running Windows 95
- 24 PCs are running Windows NT
- All workstations will be upgraded to Office 97 Standard Edition
- Helpdesk calls per station are 4 per month lasting an average of 20 minutes per call
- All systems will be upgraded to minimum memory and hard-drive standards as set forth by the IT department
- All users will receive Operating System Training of 2 hours

The printed output of the example project (below) yields a net gain of over $3 million over 3 years by migrating to a 32-bit operating system platform. That's a ROI of nearly 900%! More importantly, it only takes 4 months for this project to break even (page 2). The most important analysis of the report is found on page 7. The top chart comparing 'Current Actual Costs' to 'New Annual Costs' is a critical analysis tool in understanding where costs savings are the greatest and where cost savings can be further developed. In the following pages of the report, each of the line items in the chart on page 7 are further explored and broken down into detail.

Desktop TCO and ROI Calculator

Migration Analysis

Prepared on June 10, 1998

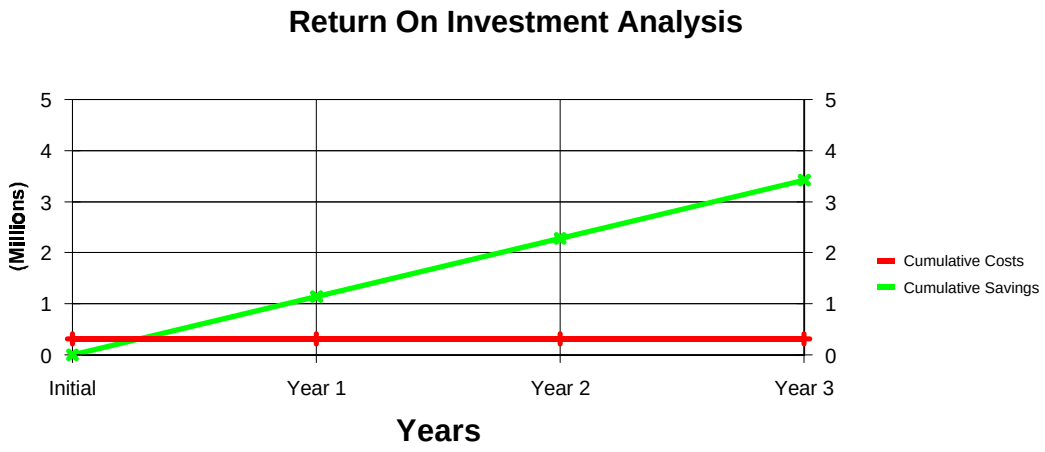
Notice – This software and information is provided to you with the understanding that there are no representations or warranties as to its suitability for your particular purpose. In not event shall there be liability for any damages, whether direct, consequential, incidental, or special, arising out of the use of or inability to use the software or information provided herewith. The ultimate responsibility for achieving calculated results remains with you.

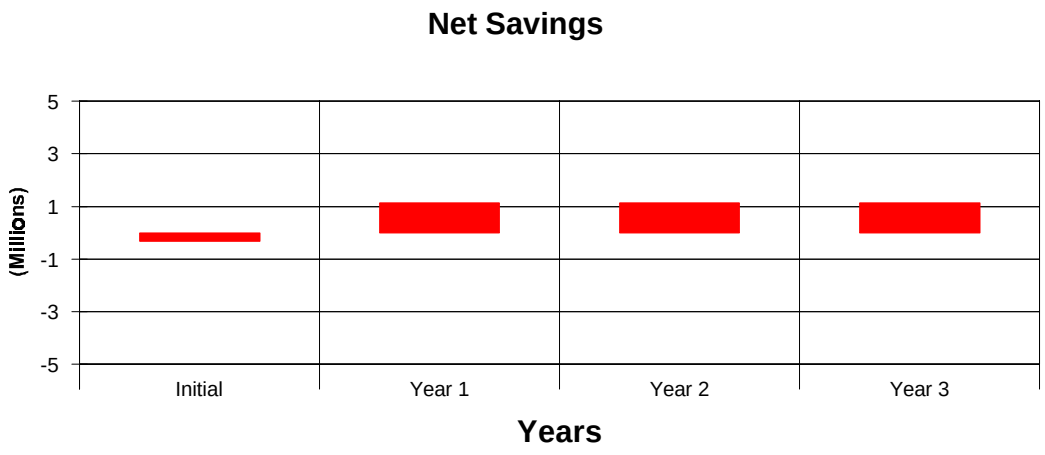
Desktop TCO And ROI Calculator - v2.0

Return On Investment

Return on Investment Analysis	Today	Year 1	Year 2	Year 3	Totals
Implementation Costs					
Hardware	$84,425	$0	$0	$0	$84,425
Software	$131,676	$0	$0	$0	$131,676
Labor and Fees	$99,442	$0	$0	$0	$99,442
Total Cost	$315,543	$0	$0	$0	$315,543
Benefits					
TCO Savings					
Direct (Budgeted) Cost Savings					
Management		$136,346	$136,346	$136,346	$409,038
Support		$87,460	$87,460	$87,460	$262,380
Development		$14,803	$14,803	$14,803	$44,409
Communications		$0	$0	$0	$0
Indirect (Un-budgeted) Cost Savings					
End User IS		$176,032	$176,032	$176,032	$528,096
Downtime					
Economic Benefits		$40,801	$40,801	$40,801	$122,403
End User Productivity and Accuracy					
Other Economic Benefits		$266,423	$266,423	$266,423	$799,269
Organizational Efficiency		$3,700	$3,700	$3,700	$11,100
Cost Avoidance		$185,016	$185,016	$185,016	$555,048
Revenue/Profit Gain		$33,303	$33,303	$33,303	$99,909
Other					
Collaboration and Communication Enablement		$3,000	$3,000	$3,000	$,9000
Web Content Creation		$44,404	$44,404	$44,404	$133,212
Application Development		$148,013	$148,013	$148,013	$444,039
Total Benefits (TCO Savings + Economic Benefits)		$1,139,301	$1,139,301	$1,139,301	$3,417,903
Cumulative Costs	$315,543	$315,543	$315,543	$315,543	$315,543
Cumulative Benefits		$1,139,301	$2,278,602	$3,417,903	$3,417,903
Net Gain (Loss)	-$315,543	$1,139,301	$1,139,301	$1,139,301	$3,102,360

Cost of Funds (Rate)	10%
Return on Investment Summary ROI Dollars (Per Project)	$3,102,360
ROI Percentage (Per Project)	898%
NPV Dollars (Based on cost of funds Percentage)	$2,517,730
IRR (Annualized)	357%
Months to Break even	4





Implementation Costs

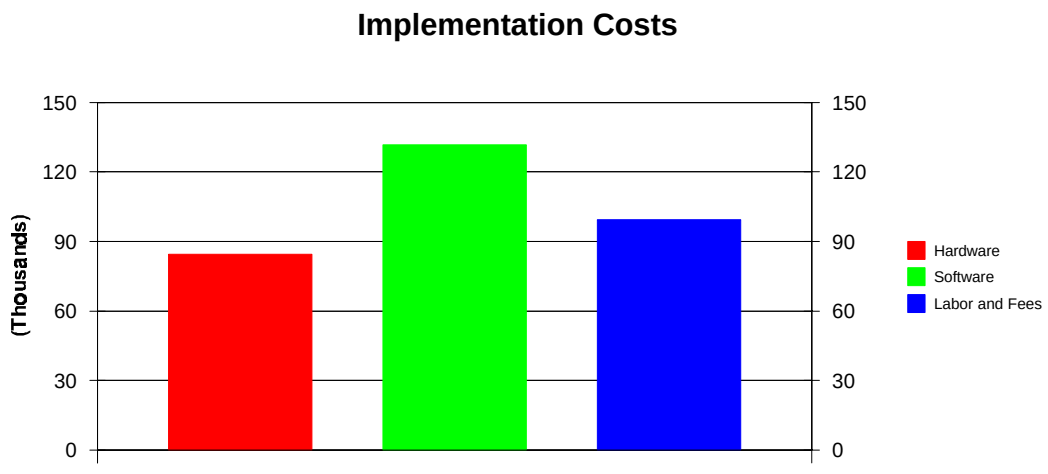
Implementation Costs	Totals
Hardware Upgrade Results	
Computer Replacements	$22,500
New SMS/ZAK Servers	$60,000
Equipment Upgrades/Other	$1,925
Software Upgrade Results	
Desktop Upgrades	$113,676
Server Upgrades	$18,000
Upgrade Fees and Labor Results	
Planning and Installation	$14,821
Training	$67,621
Other	$17,000
Upgrade Costs Totals	**$315,543**

Hardware Upgrade Results	Units	Cost/Unit	Total Cost
Computer Replacements	15	$1,500	$22,500
Total New SMS/ZAK Servers	12	$5,000	$60,000
Processor Upgrades	0	$250	$0
Memory Upgrades (in 8MB units)	15	$75	$1,125
Storage Upgrades (in 1 GB units)	4	$200	$800
Other	0	$0	$0
Total Hardware Upgrades			**$84,425**

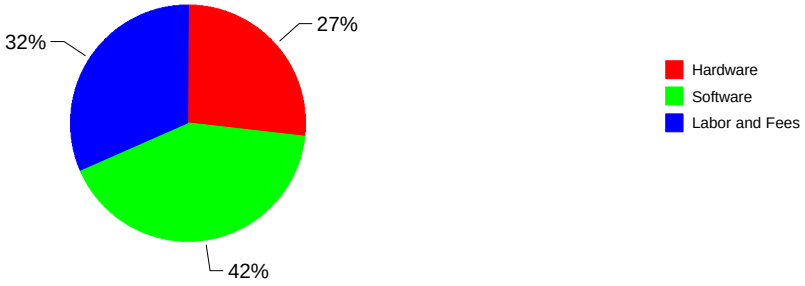
Software Upgrade Results	Units	Cost/Unit	Total Cost
Desktop Software			
Operating System	76	$101	$7,676
Office 97 – Standard	200	$388	$77,600
Office 97 – Professional	0	$466	$0
SMS and ZAK	200	$142	$28,400
Subtotal – Desktop Software			$113,676
Server Software			
Operating System	12	$500	$6,000
SMS and ZAK	12	$1,000	$12,000
Subtotal – Server Software			$18,000
Total Software Upgrades			**$131,676**

Upgrade Labor, Training and Fees					
	Average Hours Per Upgrade	Number of Upgrades	Total Hours	Rate Per Hour	Total
Planning and Installation					
95/NT Upgrade Planning	1.00	76	76	$36.06	$2,741
Office '97 Planning	0.10	200	20	$36.06	$721
SMS Planning	0.12	200	24	$36.06	$865
ZAK Planning	0.00	0	0	$36.06	$0
Installation – Hardware	1.28	46	59	$36.06	$2,128
Installation – Operating System	0.21	76	16	$36.06	$577
Installation – SMS	0.00	200	0	$36.06	$0
Installation – ZAK	0.48	200	96	$36.06	$3,462
Office 97 Installation – Software	0.83	200	167	$36.06	$6,010
Office 97 Savings With NIW	-0.23	200	-47	$36.06	-$1,683
Office 97 Savings With Automated Policies	0.00	200	0	$36.06	$0
Office 97 Savings With SMS	0.00	200	0	$36.06	$0
Total Planning and Installation					**$14,821**

	Hours Per Person	Number of People	Total Hours	Rate Per Hour	Total
Training					
User Training – Operating System	2	200	400	$17.79	$7,116
CBT User Training – Application	16	200	3200	$17.79	$56,928
Classroom User Training – Application	16	0	0	$17.79	$0
Desktop Administrator Formal Training	40	2	80	$36.06	$2,885
Help Desk Support Personnel Formal Training	40	1	40	$14.42	$577
Training Course Development			8	$14.42	$115
Training Course Software, Manuals, Course Fees					$0
Total Formal Training Labor and Fees					$67,621
Outsourced Upgrade Fees					$12,000
Other Additional Costs					$5,000
Total Other Labor and Fees					$17,000
Total Upgrade Labor + Training + Other					$99,442



Implementation Costs By Category



TCO Savings

TCO Savings	Current Actual Cost	New Annual Cost
Management		
Network Management	$129,888	$96,718
Systems Management	$185,276	$105,251
Storage Management	$53,441	$30,290
Outsourced Management Fees	$15,000	$15,000
Support		
Help Desk (Tier I & II)	$46,144	$11,246
Operations Labor	$126,041	$87,759
Operations Fees	$52,000	$37,720
Development		
Development Labor	$37,751	$22,948
Development Fees	$0	$0
Communications	$48,000	$48,000
End-User IS	$264,929	$88,897
Downtime		
Planned	$23,312	$23,032
Unplanned	$90,046	$49,525
Total Cost of Ownership	$1,071,828	$616,386
	TCO Reduction	**Cost Savings**
Estimated Savings Per Year	**42%**	**$455,442**

Management	Current		After Upgrade			
	Annual Labor Total (Hours)	Annual Cost Total	32 Bit and SMS Savings	Additional Office 97 Savings	New Annual Cost Total	Annual Savings
Network Management						
Troubleshooting and Repair (Tier III support)	260	$9,376	61%	0%	$3,657	$5,719
Traffic Management and Planning	572	$20,626	19%	0%	$16,616	$4,010
Performance Tuning	560	$20,194	24%	0%	$15,380	$4,814
User Administration (Changes to Users)	1190	$42,911	0%	0%	$42,911	$0
Operating System Support	182	$6,563	32%	0%	$4,463	$2,100
Maintenance Labor	372	$13,414	28%	0%	$9,658	$3,756
Tier II Support Labor	466	$16,804	70%	20%	$4,033	$12,771
Total	3602	$129,888			$96,718	$33,170
Systems Management						
Systems Research and Planning	102	$3,678	0%	0%	$3,678	$0
Evaluation and Purchase	182	$6,563	0%	0%	$6,563	$0
Software Licensing and Distribution	2640	$95,198			$55,267	$39,931
Asset Management	134	$4,832	65%	14%	$1,454	$3,378
Application Management	604	$21,780	75%	11%	$4,792	$16,988
Security and Virus Protection	232	$8,366	49%	0%	$4,280	$4,086
Hardware Configuration/ Re-configuration	778	$28,055	30%	0%	$19,639	$8,416
Hardware Installation	466	$16,804	43%	0%	$9,578	$7,226
Total	5138	$185,276			$105,251	$80,025

Management	Current		After Upgrade			
	Annual Labor Total (Hours)	Annual Cost Total	32 Bit and SMS Savings	Additional Office 97 Savings	New Annual Cost Total	Annual Savings
Storage Management						
Disk and File Management	818	$29,497	55%	0%	$13,274	$16,223
Storage Capacity Planning	32	$1,154	0%	0%	$1,154	$0
Data Access Management	348	$12,549	35%	0%	$8,157	$4,392
Backup and Archiving	158	$5,697	32%	0%	$3,853	$1,844
Disaster Planning and Recovery	96	$3,462	20%	0%	$2,770	$692
Repository Management	30	$1,082	0%	0%	$1,082	$0
Total	1482	$53,441			$30,290	$23,151
Outsourced Management Fees		$15,000	0%	0%	$15,000	$0
Total Annual Management Savings						**$136,346**
Total Annual Savings Per Desktop						**$681.73**

Support	Current		After Upgrade			
	Annual Labor Total (Hours)	Annual Cost Total	32 Bit and SMS Savings	Additional Office 97 Savings	New Annual Cost Total	Annual Savings
Help Desk (Tier I & II Support)						
Average Number of Calls Per Month Per Asset	4.0		36%	30%	1.79	
Average Duration of Each Call (Minutes)	20.0		36%	15%	10.88	
Help Desk Staff Burdened Salary (Dollars/Hour)	$14.42				$14.42	
Total Costs Per Asset Per Year	$230.72				$56.23	
Total Person Hours Per Year	3200				780	
Total Costs Per Year		$46,144			$11,246	
Help Desk Support Savings						$34,898
Operations Labor						
IS Administrative Assistant	344	$12,405	20%	0%	$9,924	$2,481
Management	372	$13,414	35%	0%	$8,719	$4,695
Casual Learning (IT)	812	$11,709	0%	0%	$11,709	$0
Vendor Management	482	$17,381	0%	0%	$17,381	$0
Training Course Development	144	$4,500	0%	0%	$4,500	$0
IS Training (Delivery and Time)	768	$24,000	0%	0%	$24,000	$0
End User Training (Delivery)	240	$7,500	45%	20%	$3,302	$4,198
End User Training	960	$13,843	49%	46%	$3,827	$10,016
Travel Time	488	$17,597	88%	0%	$2,182	$15,415
Purchasing	256	$3,692	40%	0%	$2,215	$1,477
Total	4866	$126,041			$87,759	$38,282

Support	Current		After Upgrade			
	Annual Labor Total (Hours)	Annual Cost Total	32 Bit and SMS Savings	Additional Office 97 Savings	New Annual Cost Total	Annual Savings
Operations Fees						
Maintenance Contracts		$11,600	0%	0%	$11,600	$0
Support Contracts		$10,000	0%	0%	$10,000	$0
Training Course, Certification Fees		$10,000	0%	0%	$10,000	$0
Travel		$20,400	70%	0%	$6,120	$14,280
Purchasing		$0	0%	0%	$0	$0
Total		$52,000			$37,720	$14,280
Total Annual Support Savings						**$87,460**
Total Annual Savings per Desktop						**$437.30**

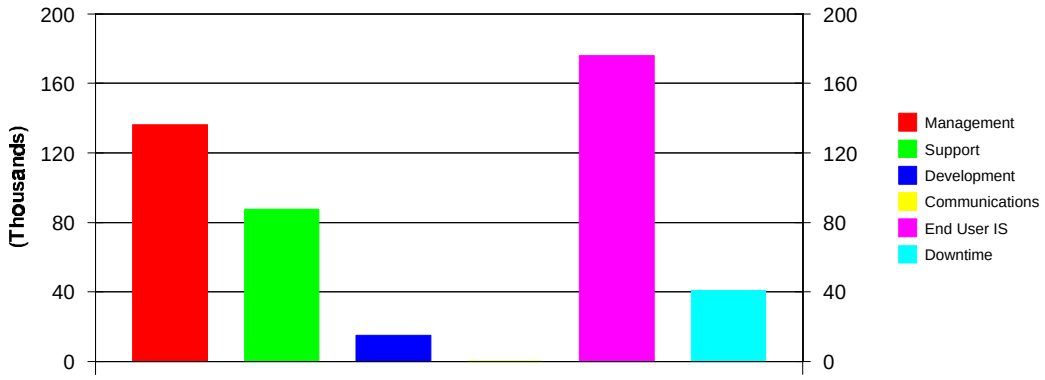
Development	Current		After Upgrade			
	Annual Labor Total (Hours)	Annual Cost Total	32 Bit and SMS Savings	Additional Office 97 Savings	New Annual Cost Total	Annual Savings
Development Labor						
Design and Development	1094	$34,188	0%	40%	$20,513	$13,675
Testing	76	$2,375	0%	40%	$1,425	$950
Documentation	38	$1,188	0%	15%	$1,010	$178
Total	1208	$37,751			$22,948	$14,803
Development Fees						
Design and Development		$0	0%	0%	$0	$0
Testing		$0	0%	0%	$0	$0
Documentation		$0	0%	0%	$0	$0
Total		$0			$0	$0
Total Annual Development Savings						$14,803
Total Annual Savings Per Desktop						$74.02

Communications	Current		After Upgrade			
	Annual Labor Total (Hours)	Annual Cost Total	32 Bit and SMS Savings	Additional Office 97 Savings	New Annual Cost Total	Annual Savings
Communications Fees		$48,000	0%	0%	$48,000	$0
Total Annual Communication Savings						$0
Total Annual Savings Per Desktop						$0.00

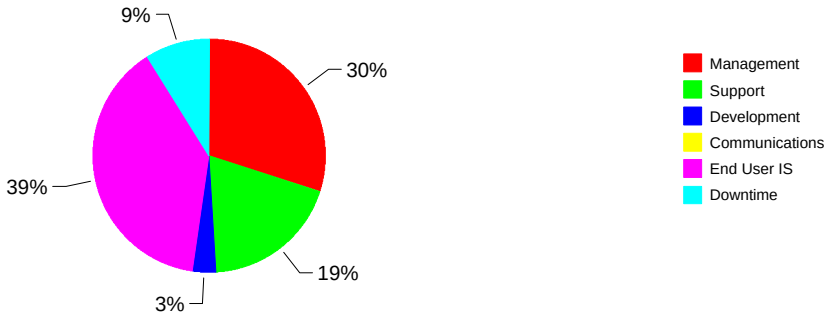
End User IS	Current		After Upgrade			
	Annual Labor Total (Hours)	Annual Cost Total	32 Bit and SMS Savings	Additional Office 97 Savings	New Annual Cost Total	Annual Savings
Peer and Self Support	9536	$169,645	60%	30%	$47,358	$122,287
Casual Learning (End User)	3916	$69,666	35%	20%	$36,159	$33,507
End User Scripting and Development	1440	$25,618	70%	30%	$5,380	$20,238
Total	14892	$264,929			$88,897	$176,032
End User IS Annual Savings						$176,032
Total Annual Savings Per Desktop						$880.16

Downtime	Current		After Upgrade			
	Annual Labor Total (Hours)	Annual Cost Total	32 Bit and SMS Savings	Additional Office 97 Savings	New Annual Cost Total	Annual Savings
Planned Downtime						
Monthly Planned Downtime Hours		2.1	1%	0%	2.1	
Users Affected By Each Planned Downtime Event		26%			26%	
Labor Rate		$17.79			$17.79	
Total Annual Productivity Losses		$23,312			$23,032	$280
Unplanned Downtime						
Monthly Unplanned Downtime Hours Per Desktop		5.7	45%	0%	3.1	
Users Affected By Each Planned Downtime Event		37%			37%	
Labor Rate		$17.79			$17.79	
Total Annual Productivity Losses		$90,046			$49,525	$40,521
Downtime Annual Savings						$40,801
Total Annual Savings per Desktop						$204.01

TCO Savings



TCO Savings By Category

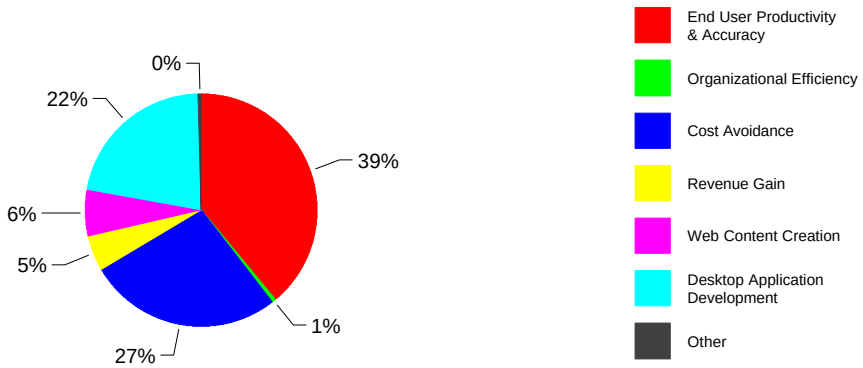


Economic Benefit

Economic Benefits	Current Actual Cost	After Project
Productivity Benefits		
End User Productivity and Accuracy	$1,332,115	$1,065,692
Other Economic Benefits		
Organizational Efficiency	$37,003	$33,303
Cost Avoidance	$925,080	$740,064
Revenue Gain	$333,029	$299,726
Other	$3,000	$0
Collaboration and Communication Enablement		
Web Content Creation	$74,006	$29,602
Application Development	$370,032	$222,019
Total	$3,074,265	$2,390,406
Total Net Benefits		$683,859

Economic Benefits	Current			After Upgrade			
	Estimated Number of FTEs	Annual Labor Total	Annual Cost Total	Improvement Percentage	Annual Labor Savings (Hours)	After Project	Annual Benefits
Productivity Benefits							
End User Productivity and Accuracy	40	74,880	$1,332,115	20%	14,976	$1,065,692	$266,423
Other Business Improvements							
Organizational Efficiency	10	2,080	$37,003	10%	208	$33,303	$3,700
Cost Avoidance	100	52,000	$925,080	20%	10,400	$740,064	$185,016
Revenue Gain	10	18,720	$333,029	10%	1,872	$299,726	$33,303
Increased HW Performance – Productivity			$3,000			$0	$3,000
Benefit #2			$0			$0	$0
Benefit #3			$0			$0	$0
Collaboration and Communication Enablement							
Web Content Creation	2	4,160	$74,006	60%	2,496	$29,602	$44,404
Desktop Application Development	10	20,800	$370,032	40%	8,320	$222,019	$148,013
Total			$3,074,265			$2,390,406	$683,859

Source Of Annual Economic Benefits



User Entered Wizard Data

Cost of Funds	
For estimating the future value of cash flows the following rate has been established	10.0%

Current Desktop Operating System and Application Composition		
Total number of desktops considered in the project evaluation:	200	
Total number of sites you have:	12	
Current Mix		
PCs and Operating Systems	**Percent Breakdown**	**Total**
Windows 3.1	38%	76
Windows 95	50%	100
Windows NT Workstation	12%	24
Other (UNIX, OS/2, Macintosh)	0%	0
Total	100%	200

Project Scope

The following technologies are planned for implementation:

- Migration to a 32-bit operating system (Windows 95 or Windows NT Workstation 4.0)
- Office 97 (integrated 32-bit office automation applications)
- Systems Management Server (to help perform the migration and reduce management and support costs)

Operating System Upgrade Plans	
Target Platform (Migrating to):	Windows 95
Migrating From:	Quantity
Windows 3.1	76
Windows 95	0
Other (UNIX, OS/2, Macintosh)	0
Average Cost of Windows License	$101
Quantity of Operating System Installations to Perform	76
Will Take Advantage of Microsoft SMS in the Deployment:	Yes
Operating System Installation (Total Days)	2

Application Software Upgrade Plans		
	Standard Edition	Professional Edition
Percentage of client workstations that will have Microsoft Office 97 installed:	100%	0%
Average software upgrade costs for Office 97:	$388	$466

Deployment Strategy

The following tools have been selected for use in customizing and automating deployment; Office 97 Network Installation Wizard.

Systems Management Tools Implementation Plans	
Technology you plan to implement:	Install both ZAK and SMS
PCs to Implement ZAK and/or SMS:	Quantity
Windows 3.1	0
Windows 95	176
Windows NT Workstation 4.0	24
The quantity of the above ZAK migrations that have already been included in the operating system upgrades previously itemized:	76
Average Software upgrade costs for SMS (per unit)	$142

Systems Management Tools Deployment	
The estimated effort associated with installing SMS and ZAK:	Total Estimated Days
SMS installation	0
ZAK installation	12
Activities selected for use of SMS:	
Hardware Asset Inventory	
Software Distribution	
Help Desk Tools	
Other (Application Management, Security and Virus, etc…)	
Number of new software distributions per month	0.9
Number of updated software distributions per month	3.5

Help Desk		
Specified Costs	**Number of Calls**	**Duration**
Number of Help Desk Calls Per Asset Per Month	4.0	
Duration of Average Call (In Minutes)		20
Reduction with 32-bit	16%	0%
Reduction with Office 97	30%	15%
Reduction with SMS	24%	36%
Reduction with ZAK	0%	0%

Labor and Fees for Hardware Upgrades			
Upgrade Item	**Hours**	**Quantity**	**Hardware Costs Per Unit**
Average Cost to Replace Computers and Operating Systems	0.50	15	$1,500
New SMS and ZAK Servers	3.00	12	$5,000
Average Cost for Upgrading Computers			
Processors	1.00	0	$250
8 MB Memory	0.50	15	$75
Local Hard Disk (In 1 GB Increments)	2.00	4	$200
Other (Peripherals, Monitors, Other Network Equipment)	1.00	0	$0

Labor and Fees for Upgrade Planning			
Task	**Work Hours of Effort Per Machine**	**Work Hours of Effort -- Total**	**Number to Install (Basis)**
95/NT Upgrade Planning	1.00	76	76
Office '97 Planning	0.10	20	200
SMS Planning	0.12	24	200
ZAK Planning	0.00	0	0
Total		120	

Training		
Options	**Number of Users**	**Hours of training**
User Training - Operating System	200	2.00
CBT User Training – Application	200	16.00
Classroom User Training – Application	0	16.00
Desktop Administrator Formal Training	2	40.00
Help Desk Support Personnel Formal Training	1	40.00
	Internal Person Hours	**External Expenses**
Training Course Development Labor and Out-of-Pocket Training Expenses	8.00	$0

Labor Rates	
Personnel Categories IS Personnel	Annual Burdened Salary
Desktop and Network Administrator	$75,000
Application Developer	$65,000
Help Desk Operator (Tier 1)	$30,000
Trainer	$30,000
Desktop users	$37,000
Outsourced Upgrade Fees	$12,000
Other Additional Costs	$5,000

Business Improvements			
	Percent of Users Affected	Percent of Day Using Software	Potential Improvement Percentage
Categories Included in Analysis			
Increased Productivity	20%	90%	20%
Organizational Efficiency	5%	10%	10%
Cost Avoidance	50%	25%	20%
Revenue Gain	5%	90%	10%
Other Economic Benefits			
Describe Other Benefit Categories	Annual Benefit (Dollars)		
Increased HW Performance/ Productivity	$3,000		
Benefit #2	$0		
Benefit #3	$0		

	Incremental	Number of FTEs	Performance
Collaboration and Communication Enablement:	Fees (Dollars)	Assigned to Activity	Improvement Percentage
Web Content Creation	$20,000	2	60%
Application Development	$30,000	10	40%

Notes

Put your notes here

File Properties	
Name	
Company	
Address	
Phone Number	
FAX	
Prepared By	

Foreign Currency	
Country code	United States
Multiplier	1.00
Currency Symbol	$
Currency Placement	¤1

Appendix V – Technology Guidelines

The Technical infrastructure recommendations are organized by component, where each component is an operating portion of an overall architecture. For purposes of organization, the components handled here include:

- Systems Management
  - Network Management
  - Systems Management
  - Helpdesk
- Platform Servers
  - Enterprise Servers
  - Data Warehouse Servers
  - Workgroup Servers
- Network Backbone

General Structure

Each component is reviewed using the following structure:

- Component Overview -- A review of the component: what it is, what it does (service provided, role(s) played), and, where applicable, relationships with other components.
- Design Requirements -- A review of the recommended requirements and criteria for selecting components. The criteria outlined below are based on current best practices across a number of private sector industries. These are used as a model for public sector computing and infrastructure for Iowa.
- Survey of Available Products -- A discussion of the various market-leading alternatives for implementing the component. Identifies alternatives and presents relative strengths and weaknesses based on the criteria and requirements established for that component.

  This survey is based on generally available information on currently released products. The products reviewed were selected based on the stated requirements; these are not all-comprehensive lists. Finally, these do not represent endorsements of specific vendors, brands or products.

Other Standards

In addition to these requirements, applicable government standards should also be considered. These include, where applicable:

- Year-2000 compliance -- Mandatory for all computing components selected. Will often involve a review of relevant legacy system interfaces to ensure that related systems and information flows are millennium compliant.
- FIPS -- Federal Information Processing Standards

- NASIRE -- National Association of State Information Resource Executives
- ITAA -- Information Technology Association of America
- IEEE -- The Institute of Electrical and Electronics Engineers, Inc.

FIPS

Under the Information Technology Management Reform Act (Public Law 104-106), the Secretary of Commerce approves standards and guidelines that are developed by the National Institute of Standards and Technology (NIST) for Federal computer systems. These standards and guidelines are issued by NIST as Federal Information Processing Standards (FIPS) for use government-wide. NIST develops FIPS when there are compelling Federal government requirements such as for security and interoperability and there are no acceptable industry standards or solutions. See background information for more details.

Relevant FIPS publications include:

1. General Publications
2. Hardware and Software Standards – Computer Network Protocols, Database, Electronic Data Interchange (EDI), Operating Systems, Programming Languages
3. Data Standards – Representations and Codes
4. Computer Security Standards – Access Control, Encryption, Risk Analysis, Contingency Planning
5. Telecommunication Standards – Cables and Wiring, Coding and Character Sets, Integrated Services Digital Networks (ISDN), Security, Video Conferencing
6. Federal Telecommunication Standards

Additional information can be found at the FIPS web-site:
http://www.itl.nist.gov/div897/pubs/index.htm
A hierarchy of FIPS documents can be found in web-site:
http://www.itl.nist.gov/div897/pubs/0-tree.htm

NASIRE

NASIRE represents information resource executives and managers from the 50 states, six US territories, and the District of Columbia. State members are senior officials from an of the three branches of state government who have statewide, executive-level responsibility for the management of information resources. NASIRE also has associate and corporate memberships. Associate members are any other state and local, federal and international government officials who are involved in information resource management. Corporate members are from private and not-for-profit organizations.

Additional information can be found at the NASIRE web-site: **http://www.nasire.org/**

ITAA

The ITAA is a leading trade association representing the broad spectrum of US information technology (IT) industry, and encompasses over 9000 direct and affiliate members. Specific initiatives of interest include: Public Policy and Government Affairs, Electronic Commerce, Internet Legislation, and Y2K Compliance.

Additional information can be found at the ITAA web-site: **http://www.itaa.org/**

IEEE

The IEEE is the world's largest technical professional society. Founded in 1884 by a handful of practitioners of the new electrical engineering discipline, today's Institute is comprised of more than 320,000 members who conduct and participate in its activities in approximately 150 countries. The men and women of the IEEE are the technical and scientific professionals making the revolutionary engineering advances which are reshaping our world today.

IEEE defines and publishes several standards that are of relevance to Electronic Commerce solutions, and computing technology in general. These include standards in security and Information Technology, including ATLAS (Abbreviated Test Language for all Systems), Bus Architectures & Microprocessors/Microcomputers, Local & Metropolitan Area Networks (802.x), Portable Applications (POSIX), Software Engineering and Test Technology.

Additional information can be found at the IEEE web-site: **http://www.ieee.org/**

Survey of Available Alternatives

Systems Management

Component Overview -- A sound systems management strategy is fundamental to efficiently achieving desired levels of service. A framework for systems management includes network and asset management tools. These are discussed separately below.

Network Management

Component Overview -- Interconnected networks provide the backbone upon which Electronic Commerce applications operate. As more sophisticated networking services are provided to larger numbers of users, there is a need for cost-effective and enterprise strength network management. This not only means sufficient well trained network management personnel, but also the technology infrastructure necessary to enable them to efficiently manage the network. A key technology enabler for this function is network management software used to monitor, administer and troubleshoot these often mission-critical resources as part of an overall systems management infrastructure.

Typical functions and requirements for network management systems include:

- Management should be provided for both legacy and end-state network components
- Both local and wide area network management must be provided
- Management should be based on industry-standard protocols (SNMP, RMON)

- Specified network electronics should support industry-standard management protocols
- The architecture should provide for the ability to remotely manage network components and attached devices
- The architecture should use available protocols and technologies to simplify device address maintenance
- Network management should integrate with systems management and problem tracking to build a complete systems management environment
- Discover topology of the network environment
- Provide operational status of networked devices
- Notify of potential faults
- Monitor network traffic conditions such as packet collisions and broadcast traffic
- Log all events and/or alerts received
- Store historic network condition/traffic statistics for analysis
- Generate network utilization reports
- Forward the events/alerts received by the network management platform to other servers in order to provide an integrated enterprise technology management environment

Network Management Platform Requirements

Recommended requirements for network management platforms are outlined below. Included are suggested importance for each of the criteria.

Requirement	Comments	Importance
Capable of Managing TCP/IP Network	· Network is migrating to TCP/IP · TCP/IP is the strategic underlying protocol for Internet and intranet applications	Mandatory
Capable of Managing SNA Network	· Through either built-in functions, third party applications, or integration with NetView for MVS currently running on the mainframe	Highly Desirable
Autodiscovery of Network	· Automatically discover network topology	Mandatory
Compatibility	· Wide third-party MIBs support · Wide third-party add-on module support · Wide hardware/software third-party support	Mandatory
Base Network Management Functions	· It is desirable to have as many base network management functions as possible	Mandatory
Ease of Use	· Intuitive user interface · Multiple management console support	Highly Desirable
Cross Platform Support	· Multiple platform support · Multiple database support	Highly Desirable

Survey of Available Alternatives

HP OpenView Network Node Manager

- Market leading network management platform
- Wide third-party MIB/hardware/software support
- Supports RMON feature
- Runs on multiple platforms: HP-UX, Sun Solaris, and Windows NT

IBM/TME10 NetView for AIX

- Major competitor of HP OpenView Network Node Manager
- Wide third-party MIB/hardware/software support
- Supports RMON feature
- Runs on multiple platforms: AIX, Sun Solaris, and Digital UNIX

Cabletron SPECTRUM

- Competitor of HP OpenView Network Node Manager
- Less third-party MIB/hardware/software support than HP OpenView and IBM NetView
- Supports RMON feature
- Runs on multiple platforms: AIX, Solaris, SunOS, IRIX, HP-UX, and Windows NT
- Frame relay network management module is new
- Primarily designed for managing Cabletron networking devices

Sun Solstice Domain Manager

- Competitor of HP OpenView Network Node Manager
- Relatively lower market share
- Not enough third-party MIB support
- Weak in reporting and data repository capabilities
- Performs well in Sun-centric networks only
- Lack of cross-platform support: both server and client software runs on Sun platforms only

Network Management Platform Option Strengths and Limitations

Option	Strengths	Possible Limitations
HP OpenView Network Node Manager	· Large third-party hardware/software support · Capable of managing Novell and Windows NT servers using OpenView's NOS management application · Capable of managing IPX and Windows clients via integration with Novell ManageWise and Microsoft SMS · Capable of integrating with major systems management utilities · Supports RMON feature · Both server and client software run on multiple platforms: HP-UX, SunOS, Solaris 2.x, and Windows NT · Multiple database support: Flat Files, CA-Ingres, and Oracle	· Manages IP network only · Supports no integration with SNA network management applications · Network topology autodiscovery creates less intuitive network maps as the size of the network gets larger
IBM/TME 10 NetView AIX	· Capable of integrating with NetView/MVS using SNA Manager/6000 · Capable of managing multiple IPX and NetBIOS client and server systems: OS/2, DOS, Windows, Macintosh, and Novell · Capable of managing IBM hubs using Hub Management Program/6000 · Supports RMON features · Capable of integrating with major systems management utilities · NetView is available on IBM AIX, Sun Solaris, and Digital UNIX · Supports a large number of management consoles (approximately 30). · Multiple database support: Oracle, Sybase, DB/2, Ingres and Informix	· Base product manages IP networks only

Option	Strengths	Possible Limitations
Cabletron SPECTRUM 4.0	· Network topology autodiscovery creates more intuitive network maps than competitors · Capable of locating devices if physical or MAC addresses are unknown · Capable of managing SNA networks via SPECTRUM/Blue Vision · Integrated paging and e-mail functionality · Both server and client software run on multiple platforms: AIX, Solaris, SunOS, IRIX, HP-UX, Windows NT	· Base product manages IP network only · Does not have basic systems management capabilities competitors have, e.g., CPU utilization and disk space utilization · Supports no integration with IBM NetView for MVS for SNA network management · Supports DB Vista only. Exports to ASCII flat files, SAS, Sybase, Oracle.

Systems Management

Component Overview -- As more sophisticated computing resources are deployed in a distributed environment, there is a need for cost-effective and enterprise strength systems management. This not only means sufficient well trained operations personnel, but also the technology infrastructure necessary to enable them to efficiently manage all computing resources. A key technology enabler for this function is systems management software. This software should perform the following functions:

- Discover and inventory the hardware and software components of the servers and workstations on the network
- Schedule unattended tasks on the servers being managed and provide operational status
- Distribute software/upgrade/file packages to pre-defined groups of computers on the network
- Reverse unwanted software/upgrade/file packages to pre-defined groups of computers on the network
- Notify of potential faults
- Monitor performance of a pre-defined group of servers
- Log all events/alerts received
- Forward the events/alerts received by the systems management platform to other servers in order to provide an integrated enterprise technology management environment

Systems Management Platform Requirements

Requirement	Comments	Importance
Job Control	· Able to schedule task to be performed without operator interaction · Able to schedule tasks to be performed on target computers without end user interaction	Mandatory
Asset Management	· Able to auto-inventory the hardware and software components of servers and workstations	Mandatory
Software Distribution	· Able to manually or automatically (via job scheduling) distribute software or file packages to target computers (grouped manually or grouped base on asset inventory)	Mandatory
Event Logging	· Able to log events/alerts/errors	Mandatory
Server Performance Monitoring	· Able to monitor performance of servers on the network	Highly Desirable
Network Management Supported	· Able to communicate, forward events/alerts to and from network management platform · Multiple network management platform support	Highly Desirable

Survey of Available Alternatives

IBM TME 10/Tivoli

- Major systems management platform vendor
- Distributes and removes software packages for OS/2, Windows 95, Windows NT, and UNIX
- Integrates with major network management platforms to provide an integrated enterprise technology management environment

Microsoft SMS 1.2

- Major systems management platform vendor
- Distributes and removes software packages for DOS, Windows 95, and Windows NT
- Integrates with major network management platforms to provide an integrated enterprise technology management environment
- Remote console runs on Novell NetWare servers only

Platinum: AutoXfer, AutoXfer Inventory, AutoSys, ServerVision

- Major systems management platform vendor
- Distributes and removes software packages for Windows 95, Windows NT, and UNIX
- Integrates with major network management platforms to provide an integrated enterprise technology management environment
- Monitors server performance

CA UniCenter

- Major systems management platform vendor
- Distributes and removes software packages for Windows 95, Windows NT, and UNIX
- Integrates with major network management platforms to provide an integrated enterprise technology management environment
- Monitors server performance

HP OpenView

- Major systems management platform vendor
- Offerings specific to HP offerings on HP-UX (OEM UNIX variant) and Windows NT
- Integrates with major network management platforms to provide an integrated enterprise technology management environment
- Monitors server performance

Novell ManageWise

- Remote console runs on Novell NetWare servers only

Seagate Desktop Management Suite

- Server management tools in separate product
- Reputation for sluggish installation
- No remote control of Windows NT machine

Symantec Norton Administrator Suite - Premier Edition

- Limited capability – cannot completely inventory the hardware on Windows NT Workstation 4.0
- No remote control of Windows NT machine

Systems Management Platform Strengths and Limitations

Option	Strengths	Possible Limitations
IBM TME 10/Tivoli	· Capable of distributing software for multiple operating systems: UNIX, Windows NT 3.5x, Windows 3.11, Windows 95, Windows 3.x, OS/2 and NetWare · Asset management: automatic inventorying of software and hardware components of PC nodes and basic UNIX hardware information · Asset information can be stored in an open relational database such as Informix, Microsoft SQL Server, Oracle, and Sybase · Integrated with inventory database for target machines: group software distribution target machines by the inventory data such as memory, hard drive, or operating system · Supports integration with multiple network management platforms: HP OpenView, Cabletron Spectrum, NetView, and Sun NetManager · Can remotely control target machines (such as Windows NT, 95, 3.x, Windows for Workgroup) over local or wide area TCP/IP networks · Supports server performance monitoring for UNIX and Windows NT	· Unable to back out a software distribution · Package for software distribution must reside on a UNIX server

Option	Strengths	Possible Limitations
Microsoft SMS 1.2	· Capable of distributing software to collect system configuration inventory for multiple operating systems: Windows NT, Windows 3.11, Windows 95, Windows 3.x, DOS, Macintosh and OS/2 · Integrated with inventory database for target machines · Virus control on clients machines. · Capable of integrating with network management platforms: HP OpenView and IBM TME 10 NetView AIX · Capable of processing and forwarding SNMP messages · Capable of remote control/reboot/access/diagnosis for multiple clients: Windows NT, 95, and 3.x; DOS	· Can monitor server performance, diagnosis servers and remote control servers running Windows NT Server only · Management console runs on Windows NT Server only · Requires Microsoft SQL Server which has to be purchased separately

Option	Strengths	Possible Limitations
Platinum: · AutoXfer · AutoXfer Inventory · AutoSys/Team · ServerVision	*AutoXfer*: · Capable of distributing (and reversing) software for multiple operating systems: UNIX, Windows NT, Windows 95. DOS · Supports software distribution to local and remote sites · Capable of integrating with HP OpenView framework · Communicates with other network management platforms via SNMP *AutoXfer Inventory*: · Asset management: automatically inventories software and hardware components of PC nodes and basic UNIX hardware information · Asset information is stored in an open relational database · Integrated with inventory database for target machines: group software distribution target machines by the inventory data such as memory, hard drive space, or operating system version *AutoSys/Team:* · Software distribution can be scheduled via job control application running on UNIX or Windows NT · Provides job automation/ scheduling/management for UNIX, Windows NT, and OS/400 environment *ServerVision*: · Supports server performance monitoring for UNIX and Windows NT · Problem notification by e-mail or pager	· Package for software distribution must reside on a UNIX server · Supports integration with only one network management platform, i.e. HP OpenView. · AutoXfer Inventory currently supports only one relational database, i.e. Sybase · AutoXfer Inventory discovers hardware and software configurations of both Intel- and Solaris-based desktops · GUI console of ServerVision requires Motif (X Window Interface)

Help Desk

Component Overview-- As more sophisticated computing services are provided to larger numbers of users, there is a need for cost-effective and enterprise strength user support. This not only means sufficient well trained support personnel, but also the technology infrastructure necessary to enable them to efficiently manage the support workload. A key technology enabler for this function is automated Help Desk software to capture, process, track, and understand trouble.

The user support (help desk) environment should perform the following functions to provide enterprise user support:

- Permit users to log a trouble ticket directly into the system, as well as, by phoning the help desk
- Route trouble tickets to appropriate support personnel automatically
- Escalate trouble tickets based on pre-defined conditions
- Notify appropriate support personnel via e-mail, page, fax, etc.
- Store old tickets and the corresponding solutions in a repository for future reference
- Permit users and support personnel to search the repository for potential problem resolutions
- Log all the events and alerts received by the help desk system
- Forward the events and alerts received by the help desk system to other servers in order to provide an integrated information systems management and corporate help desk environment

The preferred alternative for the help desk environment was selected based on the data on the following pages.

Help Desk Requirements

Requirement	Comments	Importance
Ticket Handling	· Routing · Escalation	Mandatory
Ticket Notification	· E-mail · Page · Fax	Mandatory
Problem Management and Resolution	· Capable to store the problems and solutions into its repository · Capable to search for potential solutions from its repository	Highly Desirable
Asset Management	· Via either synchronization between its own asset management module with systems management platform or utilize the functions available on system management platform	Desirable
Network Management Platform Integration	· Capable to communicate with major network management platforms (e.g. HP OpenView, IBM NetView, etc.) via SNMP	Highly Desirable
Cross platform support	· Multiple platform support · Multiple database support	Desirable

Survey of Available Alternatives

Remedy Action Request System

- Market leading help desk system
- Runs on different platforms
- Supports different databases for repository

SupportMagic SQL

- Integrated paging function for ticket notification
- Runs on different platforms
- Supports different databases for repository

ASG-IMPACT

- Integrated asset management module
- Runs on different platforms
- Supports different databases for repository, including IBM DB2

BRAINSTORM

- Relatively lower market share
- Requires installation of Lotus Notes.
- No support for TCP/IP networks

ESP The Expert Support System

- Relatively lower market share
- Runs on Windows 3.x, 95, and Macintosh only

helpSTAR for Windows

- Relatively lower market share
- Supports only one database (Microsoft Access)
- No support for TCP/IP networks

Utopia/HelpDesk

- Relatively lower market share
- Runs on Windows 3.x and 95 only

Help Desk Option Strengths and Limitations

Option	Strengths	Possible Limitations
Action Request System	· Supports help desk workflow design · Customizable ticket routing, notification, and escalation · Supports automatic ticket notification via paging and e-mail · Supports Full-Text-Search and Query-by-Example for accessing potential solutions · HelpDesk monitoring using the Flashboard module to collect HelpDesk statistics such as “Calls Opened This Week” and “Calls Closed This Week” · Change Management module supports tracking User-definable change type, automates approval process, tracking test/implementation plans and risks, and storing of changes · AR System client software runs on multiple platforms: Windows, Macintosh, and UNIX · The AR System server runs on multiple UNIX platforms and Microsoft Windows NT Server · Supports web browser access · Multiple database support: Informix, Ingres, Oracle, Microsoft SQL Server, Sybase · Capable of integrating with major network management platforms: Cabletron Spectrum, HP OpenView, IBM NetView/6000, IBM TME 10, SunNet Manager, Synoptics Optivity & LattisWare, etc… · Supports asset management via integration with major systems management software, e.g. Microsoft SMS and Tally Systems NetCensus	· Reporting capability requires third party SQL report writers · Paging and faxing capability requires third party paging software and fax server software

Option	Strengths	Possible Limitations
SupportMagic SQL	· Customizable ticket escalation · Uses full-text search engine to access the knowledge base for potential solutions · Multiple network protocol support: TCP/IP, IPX/SPX, NetBIOS, NetBEUI · Multiple network operating system support: NetWare, Windows NT Server, OS/2, and Banyan · Multiple database support: Sybase SQL Anywhere, Oracle, and Microsoft SQL Server · Integrated paging support · Capable of integrating with HP OpenView or IBM NetView · Reporting capabilities using Crystal Reports	· Server runs on Windows NT and Novell NetWare only
ASG-IMPACT	· Customizable ticket tracking, notification, and escalation · Supports automatic ticket notification via voice, fax, paging and e-mail · Supports Query-by-Example for accessing potential solutions · Change Management module supports tracking user-definable change type, automates approval process, tracking test/implementation plans and risks, and storing of changes · Client software runs on multiple platforms: Windows NT, OS/2, and UNIX · Server runs on multiple UNIX platforms and Microsoft Windows NT Server · Supports asset management via IMPACT's Asset Management module · Multiple database support: DB2, Oracle, and XDB	· Not capable of communicating with major network management platforms (e.g. HP OpenView, IBM NetView/6000, IBM TME 10) via SNMP. · Limited cross platform support other than DB2: DB2 on MVS, OS/2 Windows NT, AIX HP-UX, SUN Solaris Oracle on Windows NT XDB on OS/2

This section describes guidelines for Enterprise Servers and Workgroup Servers. As several Iowa groups had expressed interest in Data Warehousing applications, a separate section following Enterprise Servers is devoted to this topic.

Enterprise Servers

Component Overview -- Enterprise servers provide critical entity-wide functions to a broad base of users and constituents. In the general case, this consists of a combination of multiple platforms, providing computing services such as core business applications, enterprise databases, messaging, and personal productivity tools to users via some network of terminals and/or desktop/laptop workstations.

A generalized distributed computing model includes additional types of computers and operating systems that will also serve as enterprise servers; some may be located in the centralized data centers while others may be located with other computing resources at the agency or even geographic area level. Enterprise servers are typically deployed where there is a need for significant computing power. Workgroup servers are discussed later in this chapter and are typically deployed where there is less of a need for computing power. This is not a clear delineation; there may be areas of overlap where either server type could suffice.

Key uses for enterprise servers include:

- Database Servers
- Applications Servers
- Enterprise Groupware/Messaging/E-mail Servers
- Data Mart/Warehouse Servers
- Network Management Server

The list of requirements that will drive the selection of enterprise servers includes reliability and availability, security, compatibility and connectivity support, scalability, ease of use and administration, and interoperability with other enterprise server platforms.

A sample requirements matrix for evaluating enterprise server operating systems is shown below. The relative importance of the criteria must be revisited for a given situation, and the appropriate weighting factors applied.

Enterprise Server Operating Systems -- Requirements Matrix

Requirement	Comments	Importance
Reliability	· Stable · Less crash prone	Mandatory
Continuous Availability	· Support failover to backup servers	Highly Desirable
Security	· Able to configure to resist unauthorized user access	Highly Desirable
Compatibility	· Wide hardware/software third-party support	Mandatory
Scalability	· Support multiple CPUs, e.g. Symmetric Multi-Processing (SMP)	Highly Desirable
Connectivity Support	· Able to connect to different peripherals · Able to connect to different networks	Desirable
Ease of Use	· Intuitive user interface · On-line help available	Mandatory
Ease of Administration	· Able to detect and configure new hardware installed · Supported by major systems management platforms	Mandatory
Appropriate for Tasks	· Support large number of end-user connections	Mandatory
Market-Leading Vendors	· Wide acceptance by the industries as enterprise operating system	Mandatory
Standards Conformance	· Conforms with relevant standards	Mandatory

Survey of Available Alternatives

Based on the above criteria, a discussion of several enterprise server operating systems follows.

Microsoft Windows NT Server 4.0

- Microsoft's strategic operating system for corporate servers
- Gaining industry acceptance as corporate server operating system
- Provides a robust and secure computing environment with an intuitive user interface similar to Windows 95

IBM OS/2 Warp Server

- IBM's strategic operating system for corporate servers
- Provides a robust and secure computing environment with an intuitive user interface

UNIX Variants

- Proven server operating system technology
- Wide industry acceptance as an enterprise server operating system
- Provides a robust, secure, and scaleable computing environment for enterprise servers
- Intuitive user interfaces are available for easier administration

Novell NetWare

A network operating system, not a general-purpose enterprise server operating system.
Deployments common for existing Novell computing shops that wish to leverage earlier investments and prolong the useful life. For new environments, Microsoft Windows NT and OS/2 warp pose strong alternatives.

Enterprise Server Operating System Option Strengths and Limitations

Option	Strengths	Possible Limitations
Microsoft Windows NT Server	· Graphical user interface · Stable operating system · Easy to install and configure · Large third-party hardware support · Runs on both Intel-based and DEC Alpha-based servers · Less expensive than UNIX servers	· Hardware, device drivers and applications have to be certified for Windows NT Server · "*All devices drivers should be recertified for NTS 4*" · (Source: "NT Server 4.0: Should Organizations Care?", N. MacDonald, Gartner Group, July 29, 1996) · Less scaleable than UNIX · "*... application scalability beyond four processors continues to be poor*." · (Source: "NT Server 4.0: Should Organizations Care?", N. MacDonald, Gartner Group, July 29, 1996) · "*UNIX vs. NT Today... 2-4 times scaling in maximum number of CPU, with high performance per processor...*" · (Source: "Emerging UNIX Server Trends", Richard Fichera, Giga Information Group, November 11, 1996)
IBM OS/2 Warp Server	· Graphical user interface · Stable operating system. · In-house expertise available	· Lack of third-party server software support · Windows 95 and NT clients do not get benefits from OS/2 Warp Server's LAN Manager · The future of the operating system is unclear · "*Companies currently using OS/2 and the MacOS should have plans in place to migrate from these platforms by the year end to avoid obsolescence*." · (Source: "The Desktop Operating System Market Projection for Year End 1996", Rob Enderle, Giga Information Group, May 23, 1996)

Option	Strengths	Possible Limitations
UNIX Variants	· Graphical user interface via X Windows system · Stable operating system · "*... most users are continuing to choose UNIX-based systems for their larger, centralized or more-business-critical application needs.*" · (Source: "Is a RISC-UNIX System Better If It Runs NT Too?", S. Winkler, Gartner Group, September 27, 1996) · Proven technology from industry leaders · *"That's because UNIX, with two decades of development and practical history, is available from such industry stalwarts as Digital Equipment, Hewlett-Packard, IBM, and Sun.*" · (Source: "Race to Control the Enterprise", J. Panettieri, J. Foley, Information Week, February 12, 1996) · More scaleable than other competitors including Microsoft Windows NT · "*... some UNIX variants can scale across 32 or more microprocessors.*." · (Source: "Race to Control the Enterprise", J. Panettieri, J. Foley, Information Week, February 12, 1996) · Large third party application support · "*... there are more than 10,000 UNIX applications to choose from a number that should assure continued market momentum*." · (Source: "Race to Control the Enterprise", J. Panettieri, J. Foley, Information Week, February 12, 1996)	· Proprietary hardware may be required depending on the UNIX Variant, e.g. IBM RS/6000 with AIX, HP 9000 with HP-UX, etc… · Requires more administrator training than other options

To illustrate selection process, an example comparison matrix is shown below. The relative importance of various requirements need to be revisited and re-calibrated according to the specifics of the situation.

A discussion of the predominant UNIX alternatives follows in the next section (Enterprise Server Hardware).

Enterprise Server Hardware Requirements

Requirement	Comments	Importance
Reliability	· Durable hardware components, e.g. hard drives with long MTBF, ECC memory, etc…	Mandatory
Continuous Availability	· Redundant components	Mandatory
Security	· Door lock · Keyboard lock	Highly Desirable
Compatibility	· Wide hardware/software third-party support	Mandatory
Scalability	· Support multiple CPUs, e.g. Symmetric Multi-Processing (SMP)	Mandatory
Room for Expansion in the future	· Memory · Hard drives	Highly Desirable
Connectivity Support	· Able to connect to different peripherals · Able to connect to different networks	Desirable
Ease of Administration	· Hardware pre-failure notification · Front panel showing operation status	Mandatory
Appropriate for Tasks	· Sufficient hardware scalability for enterprise	Mandatory
Market-Leading Vendors	· Wide acceptance by the industries as enterprise server platforms	Mandatory

Survey of Available Alternatives

DEC AlphaServer

- DEC is the leading vendor for 64-bit architecture UNIX servers
- DEC has partnerships with major enterprise application vendors such as Oracle, Informix, and Microsoft
- SMP cluster configurations are available for performance and high availability

HP 9000 Series

- HP is a major vendor of UNIX servers and workstations
- Flexible custom service contract
- High-Availability configuration is available for performance and high availability

IBM RS/6000

- IBM is a major vendor of UNIX servers and workstations
- SMP and MPP cluster configurations are available for performance and high availability

Sun Ultra Enterprise Server

- Sun is the leading vendor of UNIX servers and workstations
- Wide third-party UNIX hardware/software support
- High-Availability configuration is available for performance and high availability

Intel-based Servers

- Intel-based servers are gaining in popularity as enterprise servers using Microsoft Windows NT. As mentioned in the “Enterprise Server Operating System” section, these are not considered here. An evaluation of Intel-based servers is included in the next section, Workgroup Servers

Enterprise Server Hardware Option Strengths and Limitations

Option	Strengths	Possible Limitations
DEC AlphaServer	· Major vendor of open client/server systems. · Supports both Digital UNIX operating system and Microsoft Windows NT (Microsoft Windows NT certified) · 64-bit system architecture (hardware and Digital UNIX) · All Digital AlphaServers have the highest database performance (TPC-C benchmark) and data warehouse performance (TPC-D) compared to equivalents from HP, IBM, and Sun · Highly scaleable hardware · Supports RAID 0, 1,0+1, 3, 5 · SMP clustering option available · High-availability option is available · Supports multiple databases including Informix, Oracle, and Sybase	· Oracle 7 (or later) is currently the only application that can benefit from AlphaServer's 64-bit hardware and software architecture
HP 9000 Series	· Major vendor of open client/server systems · Highly scaleable hardware · 64-bit hardware architecture · Supports RAID 0, 1, 5 · Supports multiple databases including Informix, Oracle, and Sybase	· Current operating system (HP-UX 10.x) cannot benefit from 64-bit hardware architecture
IBM RS/6000	· Major vendor of open client/server systems · Highly scaleable hardware · Simple CPU upgrade path for systems based on PowerPC · Supports multiple databases including DB2, Oracle, and Sybase · SMP and MPP clustering options available · Optional hot-swappable redundant power supply	· RS/6000 is not the fastest RISC-based UNIX platform · *"AIX: Current RS/6000 product offerings have weak performance ratings in comparison to other RISC-based UNIX Systems"* · (Source: "Server Operating Systems: The Magnificent Seven", E. Thompson, Gartner Group, November 22, 1996)

Option	Strengths	Possible Limitations
Sun Ultra Enterprise Server	· Market leader in UNIX workstations and servers · 64-bit hardware architecture · High-availability system configuration available · Supports RAID 0, 1, 5 · Large third party server software support · Highly scaleable hardware · Supports multiple databases including DB2, Informix, Oracle, and Sybase · Optional redundant power supply available	· Current operating system (Solaris 2.x) cannot fully benefit from the 64-bit hardware architecture

Data Warehouse Servers

- A key decision for any enterprise data warehouse is the hardware to be used. Hardware is an especially important decision because:
- Volumes of data stored in a warehouse are typically large
- Users demand excellent response time due to the type of analysis and use of GUI tools
- Use of a data warehouse becomes a strategic imperative for organizations

Data Warehouse Server Platform Requirements

Requirement	Comments	Importance
Reliability	· Stable · Less crash prone	Mandatory
Continuous Availability	· Support failover to backup servers	Highly Desirable
Security	· Able to configure to resist unauthorized user access	Highly Desirable
Compatibility	· Wide hardware/software third-party support	Mandatory
Scalability	· Support multiple CPUs, e.g. Symmetric Multi-Processing (SMP) · Handle large data storage	Mandatory
Performance	· Support large number of users · Handle query intensive applications	Mandatory
Proven technology	· Tools and technologies are well tested on the platform chosen	Mandatory
Separate from Enterprise Database Host	· Operation of the data warehouse and production mainframe applications will not impact each other	Mandatory
Connectivity Support	· Able to connect to different peripherals · Able to connect to different networks	Desirable

Survey of Alternatives

IBM Mainframe running MVS operating system:

- Review use of existing capacity on the existing mainframes to support development of the first increment, lowering initial hardware costs
- Likely minimal change/learning curves, as Iowa IT know the MVS operating environment and mainframe version of DB2, reducing the learning curve for the data warehouse effort
- Other companies have successfully used the mainframe for data warehouses

IBM RS/6000 running AIX (IBM's flavor of UNIX operating system):

- The hardware and associated software are more open
- Scaleable hardware, allowing companies to start small, upgrade in small increments and grow to support large data warehouses
- Hardware and associated software better support requirements of data warehousing (parallel scans of large volumes of data)
- Consistent with the recommendation for the Enterprise Server in the previous section

Intel-based server running Microsoft Windows NT Server operating system:

- Insufficient scalability and performance for query-intensive enterprise data warehouse applications
- Improvements in clustering and high-performance storage may blur this line over time, particularly at the workgroup level

Central Warehouse Server Platform Strengths and Limitations

Option	Strengths	Possible Limitations
IBM Mainframe running MVS operating system	· Supports DB2 · Performance can be increased by adding CMOS processors	· Production applications, especially interactive CICS applications, must take priority over decision support, negatively impacting DSS performance · Users of the data warehouse are running many dynamic queries against large volumes of data, which may negatively impact production applications running on the same platform · Good performance can be achieved on the mainframe by offloading data marts and associated processing to a large middle tier, such as large Windows NT or RS/6000 machines
IBM RS/6000 running AIX	· Graphical user interface · Stable operating system · Easy to install and configure · Large third-party hardware support · Lower initial costs and lower maintenance costs than mainframe	· RS/6000 is not the fastest RISC-based UNIX platform · *"AIX: Current RS/6000 product offerings have weak performance ratings in comparison to other RISC-based UNIX Systems"* · (Source: "Server Operating Systems: The Magnificent Seven", E. Thompson, Gartner Group, November 22, 1996)

Workgroup Servers

Component Overview -- In a traditional legacy mainframe host-centric computing environment, workgroup servers are not a significant component of that environment. In the future, workgroup servers and operating systems will provide substantial computing services where the power of enterprise servers is not necessary. These servers will likely be distributed throughout both agency and even geographic-based environments; some may be located in the datacenter to serve both local and branch users, while others will be located at branch facilities.
Key uses for workgroup servers include:

- Shared File and Application (personal productivity tools) Servers
- Print Servers
- Remote Access Servers
- Local Groupware/Messaging/e-mail Servers
- Systems Management Server
- DHCP Servers
- DNS/WINS Servers

The preferred alternative for workgroup servers and operating systems was selected based on the data on the following pages.

Workgroup Server Operating System Requirements

Requirement	Comments	Importance
Reliability	· Stable · Less crash prone	Mandatory
Continuous Availability	· Support failover to backup servers	Highly Desirable
Security	· Able to configure to resist unauthorized user access	Highly Desirable
Compatibility	· Wide hardware/software third-party support	Mandatory
Scalability	· Support multiple CPUs, e.g. Symmetric Multi-Processing (SMP)	Highly Desirable
Connectivity Support	· Able to connect to different peripherals · Able to connect to different networks	Desirable
Ease of Use	· Intuitive user interface · On-line help available	Mandatory
Ease of Administration	· Able to detect and configure new hardware installed · Supported by major systems management platforms	Mandatory
Appropriate for Tasks	· Support services such as DHCP, DNS, WINS, etc… · Supported by workgroup applications including messaging, e-mail, help desk, etc…	Mandatory
Market-Leading Vendors	· Wide acceptance by the industries as workgroup server operating system	Mandatory

Survey of Available Alternatives

Microsoft Windows NT Server 4.0

- Microsoft's strategic operating system for corporate servers
- Gaining industry acceptance as corporate server operating system
- Provides a robust and secure computing environment with an intuitive user interface similar to Windows 95

IBM OS/2 Warp Server

- IBM's strategic operating system for corporate servers
- Provides a robust and secure computing environment with an intuitive user interface

Novell NetWare

- A network operating system, not a general-purpose enterprise server operating system

UNIX Variants

- Not as preferred a platform for third-party software developers as available alternatives
- Not as cost-effective for workgroup applications as available alternatives
- More difficult to administer in an environment where administration is often performed by less experienced individuals

Workgroup Server Operating System Option Strengths and Limitations

Option	Strengths	Possible Limitations
Microsoft Windows NT Server	· Graphical user interface · Stable operating system · Easy to install and configure · Large third-party hardware support · Runs on both Intel-based and DEC Alpha-based servers · Less expensive than UNIX servers	· Hardware, device drivers and applications have to be certified for Windows NT Server · "*All devices' drivers should be re-certified for NTS 4*" · (Source: "NT Server 4.0: Should Organizations Care?", N. MacDonald, Gartner Group, July 29, 1996) · Less scaleable than UNIX · "*... application scalability beyond four processors continues to be poor*." · (Source: "NT Server 4.0: Should Organizations Care?", N. MacDonald, Gartner Group, July 29, 1996) · "*UNIX vs. NT Today... 2-4 times scaling in maximum number of CPU, with high performance per processor...* " · (Source: "Emerging UNIX Server Trends", Richard Fichera, Giga Information Group, November 11, 1996)
IBM OS/2 Warp Server	· Graphical user interface · Stable operating system · In house expertise available	· Lack of third-party server software support · Windows 95 and NT clients do not get benefits from OS/2 Warp Server's LAN Manager · The future of the operating system is unclear · "*Companies currently using OS/2 and the MacOS should have plans in place to migrate from these platforms by the year end to avoid obsolescence*." · (Source: "The Desktop Operating System Market Projection for Year End 1996", Rob Enderle, Giga Information Group, May 23, 1996)

Workgroup Server Hardware Requirements

Requirement	Comments	Importance
Reliability		Mandatory
Continuous Availability	· Redundant components	Highly Desirable
Security	· Door lock · Keyboard lock	Highly Desirable
Compatibility	· Wide hardware/software third-party support	Mandatory
Scalability	· Support multiple CPUs, e.g. Symmetric Multi-Processing (SMP)	Highly Desirable
Room for Expansion in the future	· Memory · Hard drives	Highly Desirable
Connectivity Support	· Able to connect to different peripherals · Able to connect to different networks	Desirable
Ease of Administration	· Hardware pre-failure notification · Front panel showing operation status	Mandatory
Appropriate for Tasks	· Sufficient scalability for workgroup applications	Mandatory
Market-Leading Vendors	· Wide acceptance by industries as workgroup server platforms	Mandatory

Survey of Available Alternatives

Compaq ProLiant

- Compaq is a leading vendor of Intel-based servers
- Reputation for reliability and good customer service

DEC Prioris

- DEC is a major vendor of Intel-based servers
- Flexible customer service contract

HP NetServer

- HP is a major vendor of Intel-based servers
- Flexible customer service contract

IBM PC Server

- IBM is a major vendor of Intel-based servers

Dell, Gateway, etc.

- Emerging players in large-scale corporate servers and desktops arena
- Operate in a direct-sales approach

Workgroup Server Hardware Option Strengths and Limitations

Option	Strengths	Possible Limitations
Compaq ProLiant	· Market leader in Intel-based servers · Microsoft Windows NT certified · Rack mount chassis available · Small and large footprints are available for different types of servers including file/print servers, application servers, and database servers · The full load large footprint system has the highest database performance (TPC-C benchmark) compared to the equivalents from Digital, HP, and IBM · System supports either Pentium or Pentium Pro CPUs depending on the models · Supports up to 2GB of ECC memory using DIMMs on large footprint · Supports hot-swappable hard disks · Supports RAID 0, 1, 4, 5 · High I/O performance using new dual-peer PCI bus architecture · Automatic server recovery · Pre-Failure warranty available for on site replacement of CPUs, memory, and hard disks if the system flags a potential failure	· System scales up to 4 Intel CPUs only · Supports less expansion slots (eight total slots: 4 PCI, 1 PCI used for NIC, 2 PCI/EISA, 1 EISA) than HP NetServer LX · Less internal disk bays than competitors · No redundant cooling fans · Redundant power supply is optional · No upgrade path from small footprint to large footprint

Option	Strengths	Possible Limitations
Digital Prioris	· Major vendor of Intel-based PCs and servers · Rack-mountable in 81”x36” cabinet · System supports either Pentium or Pentium Pro CPUs depending on the models · Currently supports up to 2GB of ECC memory using DIMMs · Supports hot-swappable hard disks · Supports RAID 0, 1, 5, 0+1 · Supports the most expansion slots (ten total slots: 7 PCI, 1 PCI/EISA, 4 EISA) · Microsoft Windows NT certified · Redundant cooling fans standard · Redundant power supply standard · Front panel displays operational status: CPU, memory, fan, power supply, etc… · Automatic server recovery · Less expensive than UNIX servers	· System scales up to 4 Intel CPUs only · Only large footprint is available for all types of servers

Option	Strengths	Possible Limitations
HP NetServer	· Major vendors of Intel-based PCs and servers · Rack-mountable in standard 19-inch rack · Small and large footprints are available for different types of applications · System supports either Pentium or Pentium Pro CPUs depending on the models · Supports up to 2GB of ECC memory using DIMMs on large footprint · Supports up to 12 hot-swappable hard disks on large footprint · Supports RAID 0, 1, 5 and 0+1 · High I/O performance using new dual-peer PCI bus architecture · Supports more expansion slots (ten total slots: 5 PCI, 1 PCI for disk array controller, 4 EISA) than Compaq ProLiant 5000 · High-availability options beyond Microsoft's Wolfpack (with HP's MC/Service Guard) · Redundant cooling fans standard · Redundant hot-swap power standard · Automatic server recovery · Less expensive than UNIX servers · Optional 24x7 support available from HP customer service	· System scales up to 4 Intel CPUs only. · No upgrade path from small footprint to large footprint
IBM PC Server	· Major vendors of Intel-based PCs and servers · Rack-mountable in IBM's PC Server Rack Enclosures · System supports either Pentium or Pentium Pro CPUs depending on the models · Currently supports up to 1GB of ECC memory using DIMMs · Supports up to 12 hot-swappable internal hard disks. · Supports RAID 0, 1, 5 · High I/O performance using new dual-peer PCI bus architecture · Automatic server recovery · Less expensive than UNIX servers	· System scales up to 4 Intel CPUs only · Redundant power supply is optional · Only large footprint is available for all types of servers

Network Backbone

Component Overview --Interconnected networks provide the foundation upon which Electronic Commerce applications operate. The selection of the appropriate networking backbone is a critical factor towards the successful deployment of network computing solutions.

Network Backbone Requirements

Requirement	Comments	Importance
Reliability	· Sufficient to satisfy agreed-on availability and service levels	Mandatory
Performance	· Sufficient throughput to satisfy current network usage · Spare bandwidth for future needs	Mandatory
Scalability	· Must easily scale to support additional users and network traffic	Mandatory
Proven Technology	· Public sector is, in general, not an early adopter of new technology	Mandatory
Appropriate for Task	· Enterprise Client/Server Applications · Server-based Personal Productivity Tools and workgroup collaboration · File and Print Services	Mandatory
Standards-based	· IEEE and/or ANSI.	Highly Desirable

Network Backbone Options Evaluated

Based on the above requirements, several leading network backbone options are reviewed below.

Router Collapsed Backbone

- Proven technology providing efficient routing of different network protocols
- Wide industry acceptance
- IEEE standards exist

FDDI Backbone

- Proven technology providing high network bandwidth.
- Wide industry acceptance.
- IEEE standards exist.

Switched Ethernet Backbone

- Switching technology providing high network bandwidth and virtual LAN capabilities
- Gaining industry acceptance
- IEEE standards exist for local area network segment implementation

ATM Backbone

- Switching technology providing high network bandwidth
- Gaining industry acceptance
- Some IEEE standards exist but not finalized

Token Ring Backbone

- Established technology in IBM-centric computing environment
- IEEE standards exist for local area network segment implementation

Network Backbone Strengths and Limitations

Option	Strengths	Possible Limitations
Router Collapsed Backbone	· Provides protocol control · Suitable for directing network traffic between political boundaries or sub-nets · Uses access-list to control network access privileges · Relatively simple implementation: only one Internetworking device to manage	· Router connections will become bottlenecks as many users access shared server farm · Upgrade to higher-performance routers or FDDI rings will be needed to improve throughput
FDDI Backbone	· Delivers 100 Mbps throughput capability with little overhead · Provides reliability features such as the optional second counter-rotating ring and IBM's Token Ring Technology · Proven technology · Wide multi-vendor support including major networking suppliers such as 3Com, Bay Networks, Cabletron, Cisco, etc…	· FDDI and its related devices are expensive · FDDI uses shared-media ring architecture · FDDI uses Token Ring frame format and requires expensive routers for translation if local area networks use Ethernet · Scalability and management issues: adding more bandwidth requires costly splitting of the FDDI ring into smaller FDDI networks joined by routers
Switched Ethernet Backbone	· A single switch module provides multiple dedicated ports for workgroup shared-media hubs and servers (actual number depends on the models provided by each vendor) · Intended to improve network performance of workgroups and building backbone · Virtual LAN capabilities create logical workgroups to ease management	· Virtual LAN technology is still young and standards are still incomplete · Virtual LAN capabilities are vendor-specific · Interoperability and management issues between products made by different vendors

Option	Strengths	Possible Limitations
ATM Backbone	· Provides dedicated bandwidth to the connections · Scaleable: Mesh of frames or cell switches may be easily extended to provide more links to workstations and servers · Capable of allocating bandwidth on demand where and when it is needed through virtual circuit switching · Virtual LAN capabilities create logical workgroups to ease management	· Technology is still young and standards are still incomplete · Currently more expensive than FDDI and Fast and Switched Ethernet which deliver proven performance · Today's operating systems and protocol stacks need to be modified to support ATM · No easy upgrade paths for today's legacy local area networks · ATM solutions require close relationships with equipment vendors
Token Ring Backbone	· Strong presence in legacy IBM environments, particularly with OS/2 and OS/400	· Bandwidth may be limited, and has not kept in step with other alternatives (e.g., Gigabit Ethernet) · May not support full range of target platforms